

# Popular Science

FOUNDED

**MONTHLY** 1872

INVENTIONS

DISCOVERIES

RADIO

AUTOMOBILES

AVIATION

HOME WORKSHOP



FRANK  
MURCH

DECEMBER

Fifty miles an hour on an ingenious ice-cycle — See page 32

25 CENTS

*In this Issue—*Radio Prize Contest

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# who tests your tubes?

WHO makes the vacuum tubes you use? is one important question. Who tests them? is another.

The same great research laboratories that developed the MAZDA lamp have developed the Radiotron. The five great factories that manufacture the MAZDA lamp, manufacture the Radiotron. And the same genius and the same scrupulous accuracy are behind the test methods developed for the RCA test laboratories.

You would not think of putting into your lighting socket today, anything but a MAZDA lamp. Why put into your radio socket, anything but an RCA Radiotron—backed by the same skill, the same engineering and manufacturing resources?

A Radiotron is far more difficult to make than an electric lamp. It demands accuracy to the hundredth of an inch. It demands ten million times rarer exhaustion of the air from the tube. And to guard against error in the turning out of hundreds of thousands of Radiotrons—to insure the high standards of uniform perfection that have made famous the names of RCA, General Electric and Westinghouse, the RCA laboratories have developed tests delicately exact. When you buy a vacuum tube—know who made and tested it. Look for the RCA mark and the name Radiotron on the base.

RADIO CORPORATION OF AMERICA  
CHICAGO NEW YORK SAN FRANCISCO



# RCA-Radiotron

MADE BY THE MAKERS OF RADIOLAS



THE • PERFECT • UNION • OF • ART • AND • SCIENCE

**DE FOREST AUDION**

is the world standard in tubes. De Forest created the first successful radio tube, and his invention made broadcasting possible. The De Forest policy of a specific type tube for each socket insures finer reception and greater distance. Price, \$3.

**DE FOREST F-5 M**

A superfine 5-tube set in two color mahogany cabinet with built-in loud speaker and concealed compartments for "A" and "B" batteries. A great distance-getter, with uncanny power to tune in and out stations at will, and gifted with splendid tonal qualities. Extremely simple to operate. No howling or hissing in tuning in. An unsurpassed value at \$110.

**DE FOREST F-5 AW**

A compact, powerful set in polished walnut that will bring joy to many a household. Gives rich volume, and has the capacity to separate stations positively so that you can pick the broadcast gems without interference. Extremely easy to operate. Price (minus tubes, loud speaker and batteries) \$90.

De Forest Radio Sets can be bought at prices ranging from \$85 to \$450.

## New De Forest Balanced Circuit Reproduces 4,275 More of Music's Tones

**D**E FOREST, by a marvelous new invention known as the De Forest Balanced Circuit, now makes possible the reception of every beautiful tone within the full compass of music.

The range of pitch for the human voice in singing is from 60 vibrations per second for a low bass voice to 1,300 for a very high soprano.

That for the piano is from 27.2 to 4,138.4. And for a large pipe organ, one of the most expressive of all musical instruments, the range is from 16 (but usually 32) to 4,138.

Other instruments of charm, such as

the cello, the violin, the clarinet and the horn, keep well within this musical scope.

The average radio set can reproduce audibly and distinctly only those tones within a pitch range of 300 to 3,000 vibrations per second. Thus, in average reception, many of the tenderest, sweetest and most expressive tones and overtones in music are never heard.

Observe, now, the comparison: The De Forest "Renaissance" Radiophone, containing the new De Forest Balanced Circuit, reproduces clearly, separately, musically, every tone within a pitch range of 25 to 7,000!

This is a pitch range 4,275 points greater than the average among radios.

From these facts, you do not have

to be an accomplished musician to realize that the De Forest "Renaissance" Radiophones W-5 and W-6, alone bring to your ear the full complement of musical sound—all its feeling, its pathos, its tenderness, its light gaiety and animation.

This increase in tone receptivity is not acquired at the expense of some other element. The traditional virtues of De Forest—ease of operation, selectivity and distance—remain as conspicuous as ever.

To appreciate the greatness of the achievement, listen to the De Forest W-6 "Renaissance" Radiophone at your nearest Authorized De Forest Dealer's

DE FOREST RADIO CO., Jersey City, N. J.

# DE FOREST *The Greatest Name in Radio*

DEALERS IN ALL CITIES AND RADIO COMMUNITIES

THE EPOCH-MAKING ACHIEVEMENT WHICH MAKES ORDINARY RADIO RECEPTION A THING OF YESTERDAY



# Popular Science Monthly

The Magazine of Invention and Discovery

DECEMBER, 1925; Vol. 107, No. 6

25 cents a Copy; \$2.50 a Year



Published in New York City at  
250 Fourth Avenue

## Coming Next Month

**Houdini Will Show You**—How to do simple tricks of magic that will mystify and entertain your friends. The third of a remarkable series of articles by the world's greatest magician.

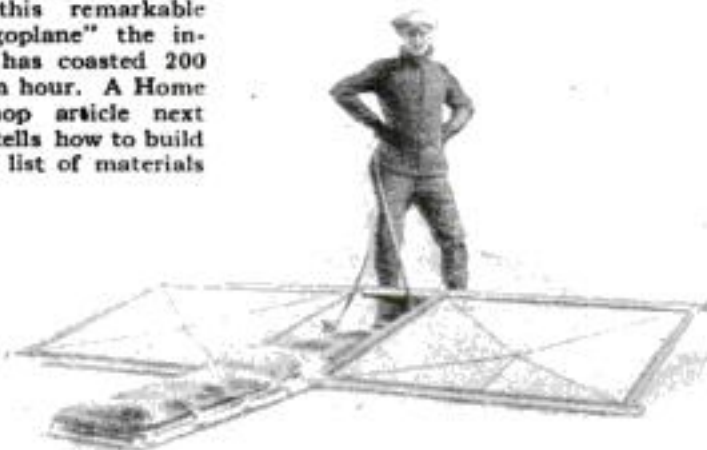
**Tips on Painting Your Car**—Gus and Joe, the veteran automobile men of the Model Garage, will explain the secret of making dull and worn finishes look like new. Expert advice that will save you money.

**Two Hundred Miles an Hour on a Toboggan**—A thrilling new winter sport made possible by the invention of an amazing new type of toboggan. An article in the Home Workshop will tell you in detail how you can build it yourself.

**The Names of Prize-Winners** in the August competition of our great \$10,000 "What's Wrong" Contest, together with correct solutions, will be announced next month. Watch for them. Awards in the July Contest are published on page 25 of this issue.

**More than 200 other fascinating articles and pictures**, giving you all the news of radio, engineering, science and invention, strange and unusual things people are doing, together with practical ideas for the automobile, the home, the home workshop, and the use of tools and machinery.

With this remarkable "toboggoplane" the inventor has coasted 200 miles an hour. A Home Workshop article next month tells how to build it, with list of materials



**IF YOU'RE** interested in radio, you won't want to miss the unusual Radio Contest that begins in this issue on page 58. Here's a chance to make yourself a fine receiver—and get paid in cash for doing it!

## POPULAR SCIENCE MONTHLY

Issued monthly. Single copy, 25 cents. Yearly subscription to United States, its possessions, and Canada, \$2.50; foreign countries, \$3. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Dunellen, N. J. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A. Copyright, 1925, by the Popular Science Publishing Co., Inc. The contents of this magazine must not be reprinted without permission. In presenting in its editorial columns numerous stories of new products of applied science, POPULAR SCIENCE MONTHLY does not underwrite the business methods of the individuals or concerns producing them. The use of POPULAR SCIENCE MONTHLY articles, or quotations from them for stock-selling schemes is never authorized.  
O. B. Capen, President and Treasurer; R. C. Wilson, Vice-President; A. L. Cole, Secretary.

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And Other Timely Articles and Pictures





# Brandes audio transformer

*"lets through"  
more tones!*

**N**OT a shade of transformer distortion in spite of a high amplification ratio of 1 to 5! And a newer, fuller range of tone for your receiver. Greater reality and mellowness, too, because the overtones are so perfectly amplified.

Trying one in your set is the simplest way of *knowing* just what a big job this little transformer does. It is priced \$4.

## And When It Comes to Acoustics

A good set deserves a good speaker. A poor set is hopeless unless it has a good speaker. You might just listen to these new speakers before you decide.

*Send for an interesting booklet describing Acoustics by Brandes*

## Brandes Products Corporation

200 Mt. Pleasant Avenue

Newark, New Jersey

Prices slightly more west of the Rockies and in Canada



The Type H—a horn of graceful lines and antique green and black finish. Great in volume—true in tone. Adjustable. \$18



The Brandes Cabinet Speaker of mahogany, finished in walnut brown. The same unit, quality of tone and even greater volume than the Type H. . . . \$30



The Brandes Cone—a truly decorative bit of furniture that conceals a remarkable speaker. . . . \$38

# Brandes

EXPERTS IN RADIO ACOUSTICS SINCE 1908





# True Stories of Success

*By Readers of Money-Making Opportunities*

**A** HOME, car, healthy family, and financial success came to Marteen Martin as a result of taking advantage of the Money Making Opportunities offered by the Coyne Electrical School and Victor J. Evans. Martin's letter wins the \$50 First Prize in the October Contest. We will let Mr. Martin tell the story of his success in his own words:

POPULAR SCIENCE MONTHLY: I have read all the Money Making Opportunities and the one of Coyne interested me most. I graduated from this school two years ago and have made about \$20,000 on this advertisement and I give all credit to POPULAR SCIENCE MONTHLY.

This advertisement has bought me a home, a car, and I am starting out with a healthy family. Another of your Money Making Opportunities is the Victor J. Evans, Patent Attorney. I sent a patent to them and in less than a week I had my patent sold for a good sum of money.—MARTEEN MARTIN, Gatesville, Tex.

**A**NOTHER man who has secured not only a financial success, but a place of importance in the business world, is Mr. E. B. C. of Brooklyn, N. Y. The Second Prize of \$25 is awarded to the writer of this letter:

CONTEST EDITOR: The ad which interests me most in your October issue is that of the International Correspondence Schools. To them I owe most of my success.

When 16 I took a course in Electrical Engineering with which I received a 12-volume library. I owe all of my knowledge of higher mathematics and electric appliance to this course.

I am now the Vice-President and General Manager of the Bel-Tone Radio Company of Brooklyn, and can always look back with satisfaction to my enrollment with the I. C. S.—E. B. C., Brooklyn, N. Y.

**T**HE advertising of the correspondence school that 12 years ago started him on the road to success is naturally the most interesting to the writer of the above letter.

Where will you be 12 years from now? If you turn to the Money Making Oppor-

## \$100 in CASH PRIZES

For the best letter of 150 words or less answering the question—*"What advertisement in the 'Money-Making Opportunities' Section interests you most—and why?"* we will pay on January 10th, the following cash prizes:

First Prize \$50.00  
Second Prize 25.00  
Third Prize 10.00  
Fifteen Prizes of \$1.00 Each 15.00

First read every advertisement in the Money-Making Opportunities Section on pages 138 to 166. Pick out the one that interests you most and then write a letter—not exceeding 150 words—telling us why you find the advertisement you have selected the most interesting.

Entries for the contest will close on December 1st. The prize winners and their letters will be published in the February issue of POPULAR SCIENCE MONTHLY.

Address your letter to  
Contest Editor  
MONEY-MAKING OPPORTUNITIES  
POPULAR SCIENCE MONTHLY  
250 Fourth Ave., New York

tunities on pages 138 to 166 of this issue, read them all carefully and write the advertisers whose offers interest you most, you, too, soon will find yourself on the high road to success.

Through books as well as resident and correspondence schools the readers of POPULAR SCIENCE MONTHLY can gain the education needed to get ahead in these days of keen competition. The Third Prize of \$10 goes to E. N. Tuckerman for his letter telling how the books published by Theo. Audel & Company have helped him:

GENTLEMEN: The advertisement that interested me most was that of Theo. Audel & Co.

I have purchased Hawkins Electrical Guides, 10 vols., Audel's Handbook of Electricity, 1 vol., and Carpenters' and Builders' Guides, 4 vols.

These are wonderful books that have assisted me greatly in the pursuit of my duties with this company.

These publications can be obtained on easy terms. They are worth their weight in gold to those who desire to better their condition and position in life.—E. N. TUCKERMANN, Hartland, Wis.

The Money Making Opportunity offered by the Chicago Engineering Works helped a man who, handicapped by lameness was making only a dollar a day, to become a well paid electrical worker.

A prize is won by Miss Josephine Hiers of Apopka, Fla., for this letter:

CONTEST EDITOR: I am most interested in the advertisement of the Chicago Engineering Works. I know a young man who fell and broke his leg. As a result he is lame and was dependent on his widowed mother. Finally he found a position at one dollar a day. He took the electrical course of the Chicago Engineering Works and is now a well paid electrical armature winder.—JOSEPHINE HIERS, Apopka, Fla.

How to use the opportunities offered by POPULAR SCIENCE MONTHLY advertisers is shown by the following letter from J. Clarence Maguire of Maguire and Horine, Electrical Dealers and Contractors of Macomb, Ill.

(Continued on page 138)

**You will find Scores of Opportunities for Making More Money in the "Money-Making Opportunities" Department, starting on page 138 of this issue.**



# UTAH

Made in Salt Lake City

Trade Mark Registered



UTAH Superflex \$14



UTAH Standard \$25



UTAH Phonospeaker \$10

## THE 4 ACES IN RADIO

### A GOOD HAND FOR ANY DEALER

**FOUR ACES**—whatever type of reproducer you favor you will find just the style you prefer in the Utah Line of Aces.

Made of semi-hard rubber there is no vibration in Utahs. All types have the same unit. Utah are manufacturers—not assemblers. We are the largest makers in America of any company devoted to the manufacturing of speakers and units.

**UTAH RADIO PRODUCTS COMPANY**  
1427 SO. MICHIGAN AVENUE CHICAGO, ILL.



UTAH SUPREME \$25

**GUARANTEE**  
Buy a Utah and use it for two weeks. Compare its tone with the best the others are able to produce. If the Utah does not give better reception return it to your dealer and he will refund your money.



# "Which Radio Set Shall I Buy?"

*The Popular Science Institute of Standards' "Buying Guide" Will Help You to Answer This Question and Avoid Mistakes*

**M**OST radio stores carry a great variety of sets, all of which appear to be carefully made of the best materials. How are you to choose?

The advice your friends and your dealer will give you is worth heeding. But much more worth heeding is the advice of a corps of radio experts who have tested scientifically all the better known sets, parts, and accessories on the market today.

As a reader of POPULAR SCIENCE MONTHLY, you have this latter advice at your command. The findings of the tests made by the Popular Science Institute of Standards, which have guided thousands of radio buyers, solved their uncertainties, and saved them costly mistakes, are available to you.

If the set you buy is approved by the Popular Science Institute, you can be certain that it will give you the utmost in efficiency for the price. It will be of sound electrical and mechanical construction, and it will stand up under usage. Rigid laboratory and practical tests determined this.

These tests are made under the supervision of the Director of the Popular Science Institute of Standards—Prof. Collins P. Bliss. Professor Bliss is also Director of Testing Laboratories at New York University and head of their Department of Mechanical Engineering. More than \$300,000 worth of equipment is at the disposal of the engineers making these tests. Thus, it can be seen that the facilities of the Institute—both as to personnel and equipment—are such as to assure tests of the very highest order—in many cases more complete and careful than would be possible in the plants or laboratories of radio manufacturers.

Material submitted to the Popular Science Institute for approval is not only subjected to scientific tests—often of an entirely original nature—but is run through an exhaustive set of practical try-outs, which determine very accurately just how the set or part in question may be expected to work in the hands of the average user. This procedure insures that any radio set, accessory, or part approved by the Popular Science Institute of Standards may be definitely guaranteed.

While no radio equipment can be advertised in POPULAR SCIENCE MONTHLY that has failed to receive



Surrounded by every variety of receiver, the amateur radio fan finds himself at a loss which one to choose. The POPULAR SCIENCE Institute of Standards supplies him with expert advice

the approval of the Institute, the tests of this organization no longer are limited to just those products offered for advertising in POPULAR SCIENCE MONTHLY.

Now that the difficult task has been completed of devising methods for testing and establishing standards in a field where little had been done previously, the Popular Science Institute has been able to extend the scope of its tests. All the leading manufacturers of radio sets, accessories, and parts (as determined by an investigation among 20,000 retailers) have had the opportunity of submitting samples of their products for test. The List of Approved Products, issued on request by the Popular Science Institute of Standards, is therefore a complete, impartial, and reliable buying guide to aid you in your radio purchases. For this list, address the Popular Science Institute of Standards, 250 Fourth Ave., New York.

**IT** IS obviously impractical for even as completely organized a bureau as the Institute of Standards to test all products listed in tool or radio catalogues advertised in our columns. Only tool and radio products specifically advertised in POPULAR SCIENCE MONTHLY are tested and approved by the Institute.

## Send for List of Approved Products

POPULAR SCIENCE MONTHLY will be glad to furnish a list of Radio and Tool Manufacturers whose products have been approved by the Institute.

## POPULAR SCIENCE Monthly Guarantee

The above seal on an advertisement indicates that the products referred to have been approved after test by the Popular Science Institute of Standards.

Popular Science Monthly guarantees every article of merchandise advertised in its columns. Readers who buy products advertised in Popular Science Monthly may expect that these products will give absolute satisfaction under normal and proper use. Our readers in buying these products are guaranteed this satisfaction by Popular Science Monthly.

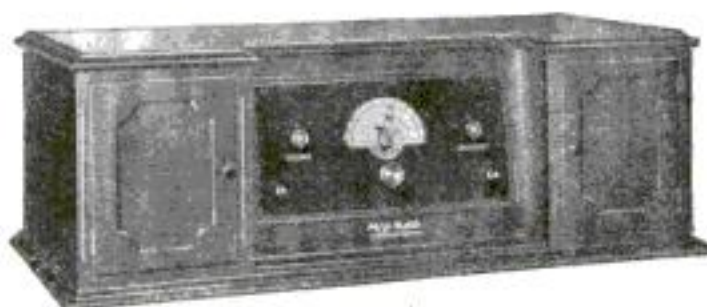
THE PUBLISHERS.





# The One-Dial MU-RAD

Transcontinental Receiver



MODEL A- \$175  
Sockets Fit All  
New Type Tubes

## Radio's Remarkable Innovation

**Y**OU made this radio receiver. To answer a tremendous demand for simplicity without sacrificing efficiency Mu-Rad Engineers developed this *New One Dial Receiver* for you. This innovation in radio reception marks the most distinctive advance since the conception of radio. In addition to the one dial control, Mu-Rad Receivers embody every principle necessary to good radio reception.

Just a slight turn of the one dial brings in any local or distant station. A station once logged always comes in at the same dial setting. It is so simple a child can operate it.

*Write Dept. D-4 for Literature*

Ask Your  
Dealer for  
Demonstration



Tune it  
Yourself



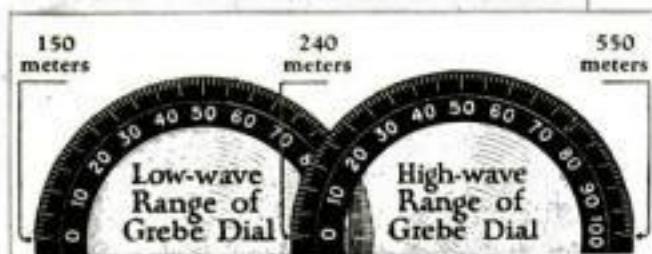
MODEL B- \$125  
Sockets Fit All New Type Tubes

## MU-RAD RADIO CORPORATION

Factory  
Asbury Park, N. J.

General Sales Office  
972 Broad Street, Newark, N. J.





The high-wave reception range of the Grebe dial (B)—from 550 down to 240 meters—equals the practical tuning range of the usual receiver. The low-wave range of the Grebe dial (A) provides additional reception down to 150 meters.



Grebe Binocular Coils  
Reg. U. S. Pat. Off.  
and  
Low-Wave Extension  
Circuits



Grebe "Colortone"



Flexible Unit Control

One dial operates two or all three; or dials may be adjusted separately, at will.

## The Three Outstanding Radio Advances of 1925

**Y**OU could not give or receive a finer Christmas gift than the Grebe Synchrophase.

Last year Grebe developed the fieldless *Binocular Coils* and *S-L-F Condenser*. This year even greater strides have been made in radio reception.

With the Grebe "Colortone" the quality of sound can be kept absolutely true and clear and is always under the listener's control, independent of the loud speaker's influence. This tone control also makes it possible to reduce, to a great degree, disturbances due to static and to suppress considerably the high-pitch frequencies caused by heterodyne interference of one station with another.

The *Low-Wave Extension Circuits* have widened the reception range so that over 100 low-wave stations not reached by other receivers can be tuned.

*Flexible Unit Control* gives one, two or three-dial control.

Both in range and quality of reception, the Grebe Synchrophase is far in advance.

*Ask your dealer to demonstrate, then compare Grebe reception with that of other receivers*

A. H. Grebe & Co., Inc., 109 West 57th Street, New York

Factory: Richmond Hill, N. Y.

Western Branch: 443 So. San Pedro St., Los Angeles, Cal.



"Take the lead and set an example of diligent toil."

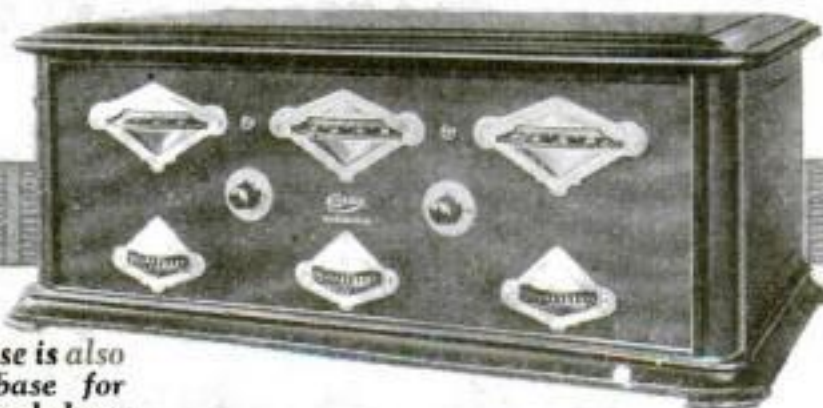
—Confucius

Much toil and great diligence have made the Synchrophase worthy of first rank in radio receivers.

Doctor T.H.

The **GREBE**  
**SYNCHROPHASE**  
TRADE MARK REG. U.S. PAT. OFF.

This company owns and operates stations WAHG and WBOQ; also low-wave re-broadcasting stations, mobile WGMU and marine WRMU



The Synchrophase is also supplied with base for batteries and in a de luxe Console model.



All Grebe apparatus is covered by patents granted and pending.





# The HARDER the JOB the Better They Like It!

*Dramatic Feats of the Salvage Corps of the Sea—  
How They Struggled to Lift the Sunken S-51*

**W**HEN the submarine S-51 was rammed and sunk by the steamship *City of Rome*, off Block Island on the New England coast, one night last fall, the radio flash of the disaster reached, first of all, two sets of men. The life-savers—the United States Coast Guard—got it, of course, and at almost the same time the radio report was relayed by telephone to a little group of men who sat, puffing their pipes and swapping yarns, in the office of a New York wrecking company.

This second group is like a fire department. Its office lights never are switched out; its tugs never are caught with stone-cold boilers, and its men literally sleep with one eye open and one ear cocked for news of a collision at night or a ship driven hard upon a lee shore.

For these men are the salvors of the sea. We call them "wreckers," but it is a misnomer, comparable almost to calling life-savers "killers." Though they deal with wrecks, their efforts go to save ships that have met with misfortune and the men aboard them. And when

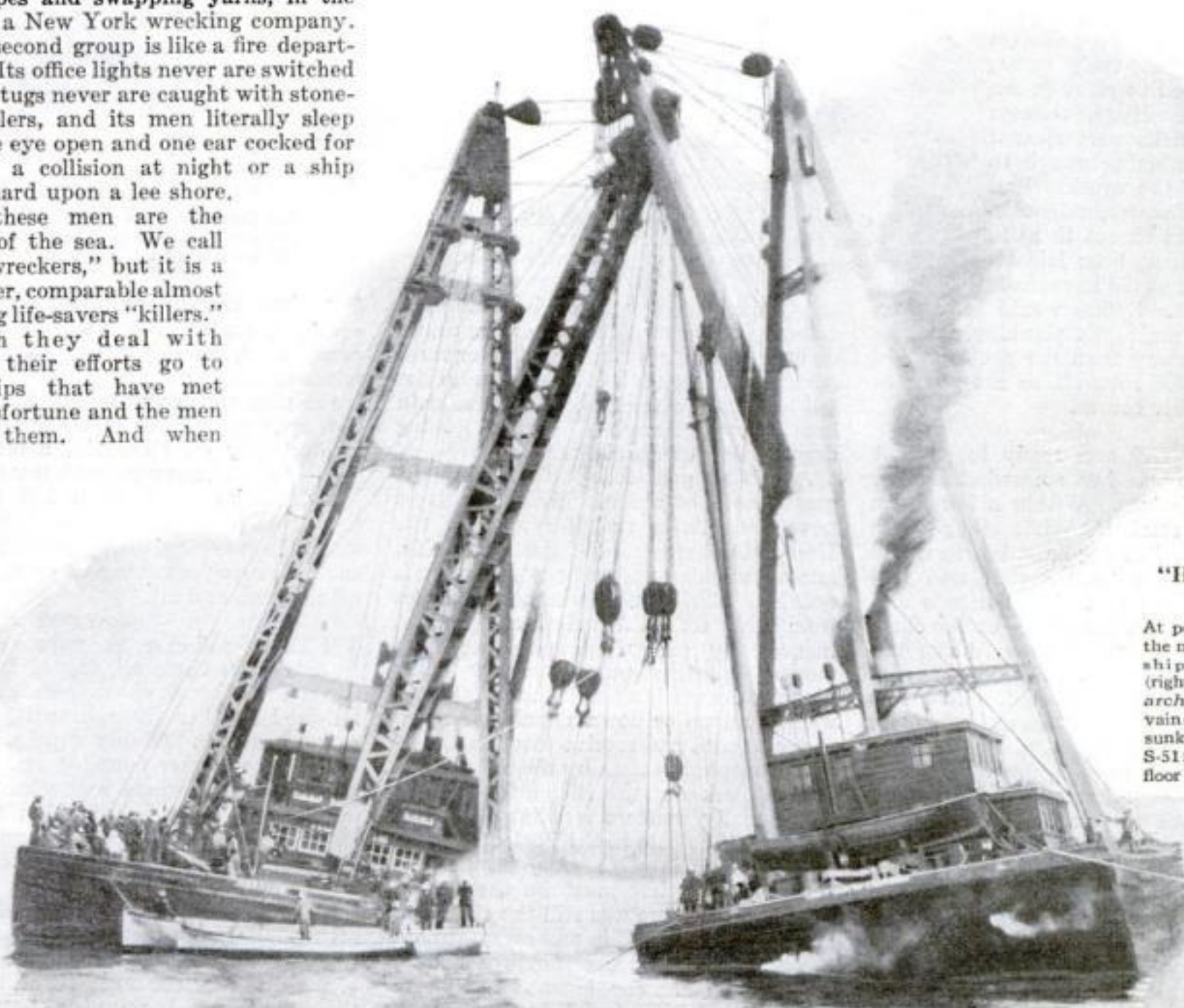
By Archibald Douglas Turnbull

rescue is found impossible, they salvage.

The news of the appalling fate that had befallen the S-51 and her crew electrified the little group in the wrecking company's office into instant activity.

Over a half-dozen telephones, calls immediately went out for Capt. Walter N. Davis, nearest wreckmaster to the scene

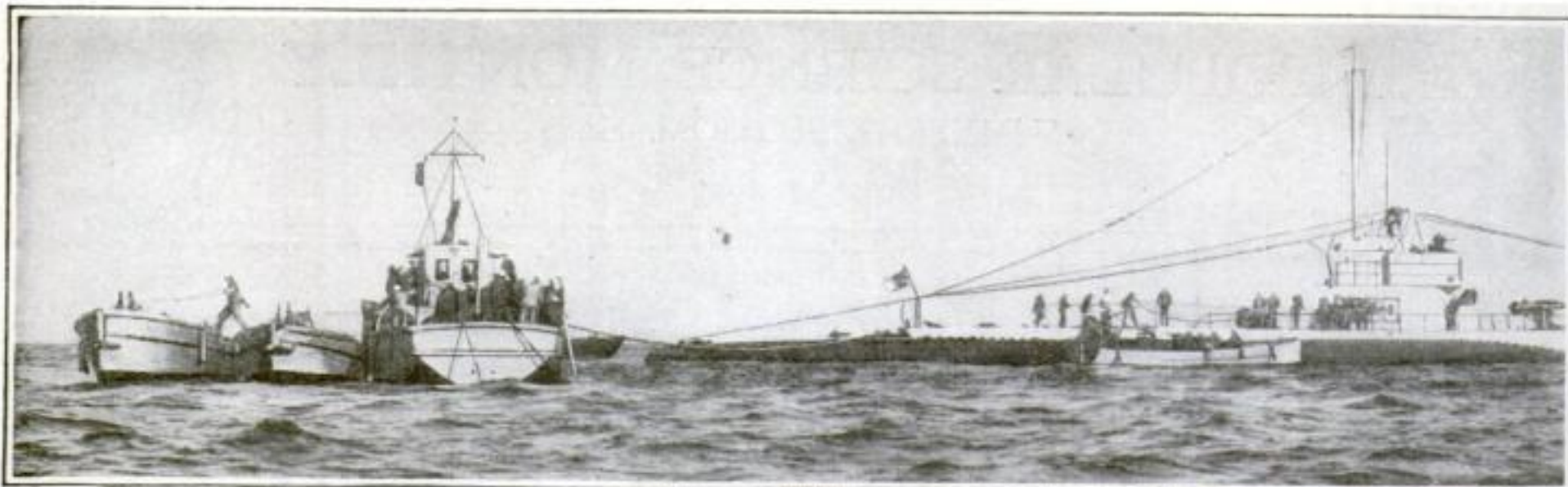
of the crash. Captain Davis was close at hand that night, and was speeding for the New England coast almost before his informant had hung up. Had he been on his way home from a job off the coast of Maine, or aboard a steamer coming up from the Bahamas, that latitude of many wrecks, it would have been the same. The wreckmaster, no matter where he is, keeps in touch with headquarters, and,



**"Heave and Hold!"**

At perilous angles, the mighty derrick ships *Century* (right) and *Monarch* (left) in their vain effort to lift the sunken submarine S-51 from the ocean floor 127 feet below





### The Sister Ship Stands By

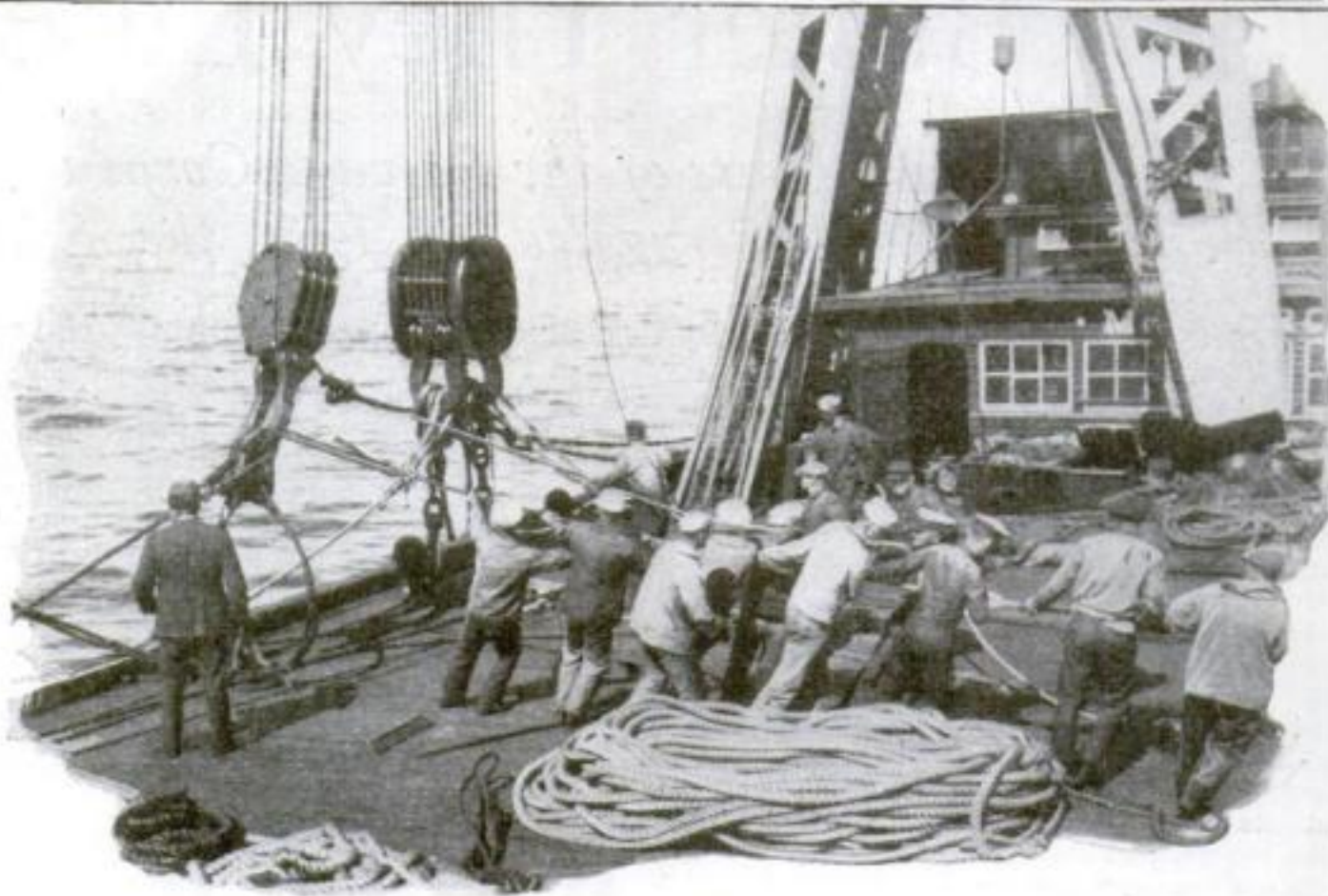
While there was still hope of keeping the crew of the S-51 alive, the submarine S-50, sister ship of the sunken vessel, stood by, pumping air into her hull. This photograph shows the S-50 moving into position next to the divers' boat, directly above the wreck

when necessary, starts for his job—as Captain Davis did that night—in new hat and stiff collar; for a wrecker's working uniform is the clothes in which he stands when the call comes.

Meanwhile, the wrecking fleet at its piers in the Hudson River had been apprised of the disaster. Stokers began shaking up their banked fires for the quick getaway that often spells the difference between success and failure on their quest. Tugs prepared to start to sea on the bell. Huge, clumsy, floating derricks were cleared for their lumbering march to the scene of the wreck. Had the giant *Monarch*, mightiest of all derricks except those in the Canal Zone, been laid up for repairs, it would have made no difference. Spikes would have been driven into makeshift planking, even as she hauled away from her dock, or new hoisting cables rove off as she pounded along upon her course.

**T**HE *Monarch* was ready to go that night, so was her somewhat smaller sister the *Century*. Within a few hours they had started. While they were towed along, heaving-lines, hawsers, and purchase blocks were sorted and laid down ready for use. The latitude and longitude known, one glance at the chart told how much water covered the unlucky submarine and what character of bottom might be expected. Tentative salvaging plans were laid on the basis of similar cases of the past.

The S-51 was running upon her lawful occasions that night, on Long Island Sound. With no word of warning to officers or crew, without a moment's time to close watertight doors and hatches, she was struck amidships, cut down, rolled over, and sunk in 20-odd fathoms—127 feet to be exact. It was an ill fate that caused the vessel to be struck near the center, her most vulnerable spot. Had the blow come forward or aft, the construction of the craft might have assured



### The Salvors at Work—A Real Man's Job

On the deck of the giant derrick ship *Monarch*—sailors handling the huge block and tackle used in the attempt to lift the S-51. At the extreme left—Capt. Walter N. Davis in charge of operations. He wears a typical wrecker's uniform—"The clothes he wore when the call came"

safety for her crew through closing the watertight doors. All happened, as things do at sea, so quickly that the two or three survivors of her crew of 34 men could not tell coherent stories, nor fully explain how they themselves escaped being dragged down with their ship.

As diving goes today, 127 feet is no great depth of water. Plenty of divers have been down that far and for the Harry Reinhartsens and the Bill Reids, famous members of the profession, it is nothing. Air supply, whether it comes from the old-fashioned hand cranks, manned by husky shipmates, or from modern electric pumps, rarely fails; diving suits are far better than they once were; and up or down signals are much easier to send and receive through underwater telephones than by the old method of one jerk on the life line—or two. What really matters is what the diver finds when he gets to the bottom.

Of course, in this case, it was the trapped crew that must be thought of first. While there was still the chance of enough air being left in any compartment to keep men alive, everything was tried to save them. For hours on end the S-50, sister ship of the sunken vessel, stood by, pumping air into her hull.

Sometimes the first expedient is sweeping—dragging a heavy steel hawser over the ocean floor, as ships sweep for enemy mines or for a transatlantic cable. That is the plan which was followed when the F-4, an earlier sister of the 51, sank so mysteriously off Honolulu, a few years ago. Agraz, a navy gunner's mate, risked his life to go down some 280 feet, in the attempt to locate the submarine, direct the sweeping, or hook on slings that could be used for raising those walled-up men, prison and all.

**I**N THAT sad case, the sweeps actually did strike the ship, tug at her—and slip off. Although one desperate attempt followed another through swift, baffling currents and in 300-foot depths, and although the hawser pounded and scraped the outer shell where any straining ear inside must have heard it, in the end there was nothing but failure. Only months afterward could pontoons bring up the F-4.

With the S-51, it was decided to try lifting. Between them, the *Monarch* and the *Century* are good for many hundreds of tons, as any one knows who has seen them make no more of a battleship's great guns than a bull elephant makes of



a tree at home or a dinner-bell in the circus. The power of the modern derrick is almost unbelievable. It literally can pluck off the side of a house, right an overturned locomotive, or bite off half a suspension bridge at one gulp. Clearly, it was up to the derricks.

FOR lifting work, the first step is to get the slings passed. Down goes the diver, armed with light line, tools, battens, and, very probably, a high-pressure water-hose. The light he gets may be daylight drifting down through green water, or it may be an electric lamp he carries with him. Perhaps the mud is soft around that buried keel, so he can push a batten through, with the light line after it, and a heavier one to follow. Or he may have to dig long and hard, clearing away with his water jet as he goes. In one way or another, working always under the physical pressure of air and the mental pressure of the dire need for haste, he must dig under that keel, to make room for a bight, or loop, of the sling to be hauled through. A submarine has relatively little beam, and the work may be much shorter than with a big ship; but always there is that cry for speed, to give the crew its last chance.

Once passed, the slings can be worked along until they are in the right position. Then, given smooth water, the hooking on at the surface is not so difficult.

"Heave away—handsomely!"

Foot by foot, the slack of the cables comes to the drums on the hoisting engines, of which the *Monarch* has no less than three. Then, as gears and friction disks take hold and bite, the cables whine protestingly in their big sheaves, while engines dig their holding-down bolts into the heavy deck-timbers and begin to "talk."

It is a terrific pull that these two

### A Famous "Wrecker" for 35 Years

One of the most famous of all "wreckers" is James McLeod (below), known as "Captain Mac," 35 years a wreckmaster and salvage expert. "'Tis a good game," he says, "and it never lets a man alone, no matter where he is. Every wreck is a new problem."



### A 127-Foot Dive—All in a Day's Work

J. W. Fraser, one of the Navy's expert divers, preparing to descend 127 feet to the sunken S-51. When the divers, puncturing the submarine's shell with under-water cutting torches, found all of the rooms flooded, hope of saving the lives of any of the crew was abandoned, and all that remained was to salvage

derricks can exert, when they are "hooked down," as salvaging men call it. The *Monarch* alone has done 300 tons in her

time. With heavy grunts, they settle to it; heeling, or listing, more and more, in spite of a hundred tons of water ballast to keep them on an even keel, until they ride at 30 degrees, with seas pouring over their inner rails and the heads of their great A-frames so close together that they can whisper pantingly to one another—"Heave and hold!"

But up there at Block Island it was no use. Those two big fellows lifted for all that was in them, time after time, without moving the 51 a single inch. And the answer was that the hope of finding some air in the submarine was a false hope. No help came to the derricks from the lifting power of a tight compartment or two. There was no air, as the divers soon proved.

To do that, they used the under-water cutting torch—for all practical purposes, the same oxyacetylene affair that every one has seen pattering and sparking away at a girder 90 or 100 feet above the street. With that torch, which is perhaps the most valuable tool recently made available to the salvor, it was

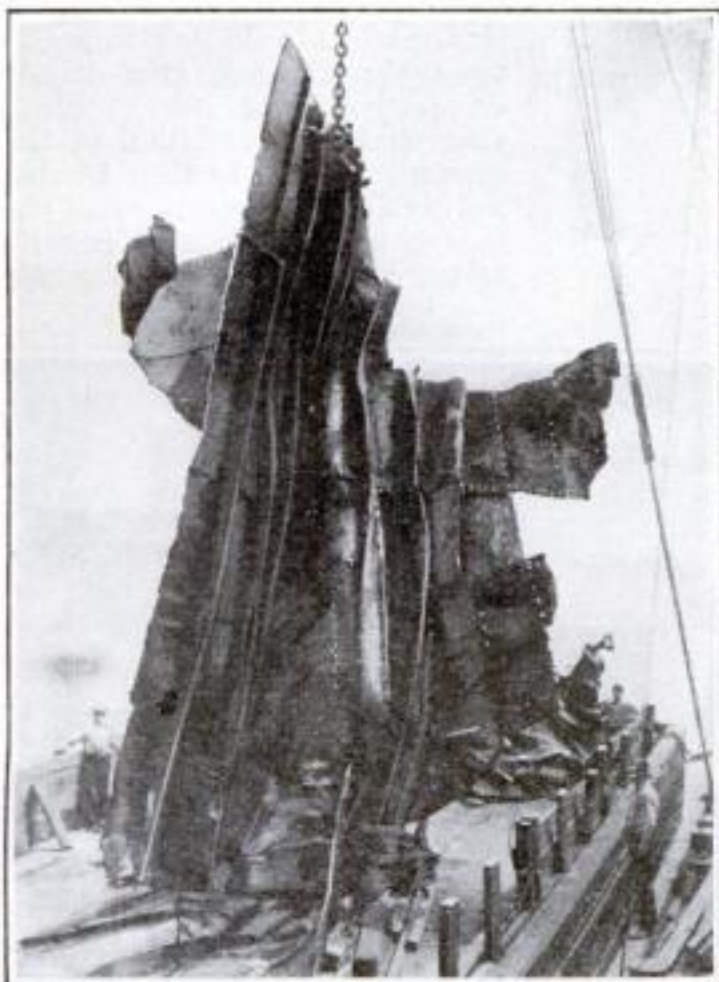
easy to cut a pencil hole in the sub's shell and watch for the air bubbles that did not come. In fact, with this torch, whole sections of ships nowadays are cut off until the ships can be brought up in pieces. But on the 51, the blowpipe cutting only proved that she must have been sent down with all her doors wide open and with not even a fighting chance for her crew. The *Monarch* and *Century* were beaten, and they turned for home, leaving it to their masters to work at some other scheme for raising.

IN A sense, of course, such a job is all in a day's work for the salvors. They have the gear, they have the experience, and they spend their lives in using both. Many of them are as offhand about it all as William Reid, when he remarked between dives: "It's a fine day down below." He makes a joke of his 100-foot jumps and will not take them seriously or as anything risky. Indeed, the divers rarely talk at all.

But there are yarns of the salvors. Sometimes they can be had from such veterans as James McLeod—Captain Mac, as all his world knows him through his 35 years as a wreckmaster and, lately, as a sort of consulting expert. If you catch him in his company's office, you will find he treats it like a ship's cross-trees, for his glance always is wandering out over the crowded harbor to watch the shipping, the wind, and the weather.

"'Tis a good game," he says, with his trace of burr that marks him for a Scot. "And we'll always have men to play it, mind ye. For there must be wrecks as long as men go to sea, in spite o' all your

(Continued on page 134)



### Raising a Wreck in Pieces

With the invention of the remarkable under-water torch, sunken ships now can be cut in pieces and brought up in such great chunks as this one shown



# How I Do My

By  
HOUDINI



## The "Switch"—A Mystifying Trick of Slate Writing

Houdini here demonstrates how easy it is, with the aid of a confederate, to "switch" slates, substituting one on which a message has been written for one held by the sitter above his head. As the medium reaches up to take the slate from the sitter's hands, the confederate takes it instead, at the same time passing the prepared slate to the medium.

SUPPOSE you were attending a spiritualistic seance. Suppose you saw every person in the room sitting in a "circle"—touching or holding the person at his right and left so that there was no chance for any one to leave the circle without his neighbors' knowing of it. Suppose, also, you knew that all the doors in the room were locked, that there were no other entrances except the windows, which were four stories above the street; that there was, in short no apparent way for a confederate to aid the medium who was conducting the seance.

Then suppose that, when the room was darkened, the medium—securely held in the circle, of course—announced that a spirit was about to enter the room through one of the windows. Suppose you heard a window open, felt the draft from the outer air, and the next instant heard solid, creaking shoes tramping across the ceiling!

You'd be mystified, I warrant you. You might even be convinced of the genuineness of that medium's claims of power to communicate with the spirits of the dead.

I WAS present at a seance in England some years ago at which a "spirit" was "materialized" under the exact conditions I have given. Yet I wasn't mystified.

At no time was I even doubtful that the medium who held the seance, though he might have been a thoroughly respectable person otherwise, as a medium was an out and out fraud—no more able to communicate with the spirits of the dead than he was to change the color of his eyes.

For the medium was—myself.

I gave that seance for the benefit of a group of English friends to demonstrate that the physical phenomena which mediums use to convince their dupes or

prospective dupes of their possession of psychic powers invariably are produced by trickery which any trained magician can duplicate or improve on.

At no time, of course, did I claim that I possessed occult powers; yet when I had completed my demonstration, half of



## Automatic Writing Easy

The fake medium thrusts both forefingers toward the sitter's eyes, and, when the latter closes his eyes, substitutes the forefinger and second finger of one hand to hold the eyelids shut. This leaves the medium a free hand to guide the pencil held by the subject

## Footwork

In this clever shoe trick, Houdini's hands and feet are covered by those of the sitter. One of the master magician's shoes, however, is braced strongly so that he slips his foot out unnoticed, then uses his toes to ring bells and write names and dates on slates

those who attended were ready to accept me as a genuine medium—until I had explained, step by step, the tricks I used to deceive them.

The "spirit" which came in through the window and walked, head down, on the ceiling weighed something around 300 pounds, for it consisted of the two members of an American acrobatic team appearing on the same music-hall bill as I.

WHEN the time came for the spirit to materialize, these two young men slipped out of the circle, and one of them took off his shoes. Meanwhile the other opened the window. Then they did a hand-to-hand balance, the shoeless one walking noiselessly around the room as he held his partner overhead, the other pounding his feet against the ceiling and bending his feet at each "step" to simulate the sounds of walking. Then they closed the window and returned to the circle, and, when the lights went up, those who were not in on the trick found everything in the room exactly as it had been before the lights had been extinguished.

So far as I know that was the first and only time that a "spirit" ever was materialized in that precise way, yet hundreds of fraudulent mediums in all parts of the United States virtually every day are using very similar tricks to aid them in preying upon the deluded, grief-stricken, desperate persons who come to them seeking consolation in their sorrow or advice in their troubles. For, as I endeavored to make plain in the first article of this series, trickery is the very foundation





# "Spirit Tricks"

## *King of Magicians Tells How to Mystify Your Friends by Slate Writing and Other Easy Feats*

stone of spiritualism as exemplified by the typical professional physical-phenomena medium.

The reason is obvious. We accept advice only from those who know more than we do ourselves. Many mediums are uneducated, ignorant persons. As mere men and women their advice would not be accepted by the most gullible. Hence, the necessity for setting themselves up as more than mere men and women; hence, the physical phenomena—the materialization of spirits, the ringing of bells, slate-writing, and the rest of their ridiculous trumpery.

Such manifestations, inexplicable and consequently mysterious and impressive to the ordinary person, speedily convince him that the medium possesses powers beyond human understanding. Therefore, he concludes, the medium is to be trusted; his advice is to be followed, even though, as has happened innumerable times, the medium advises his victim to give him all his money, deed to him all his property.

WHAT I am expressing is not merely a personal opinion. I am giving you in a few words the results of more than 35 years' ceaseless investigation of mediums and their methods. What I say is amply substantiated by court records and other unassailable documentary proof. In every case that I know of where a person has become a spiritualist believer, his skepticism—if he had any—was broken down by the physical phenomena produced by the medium's trickery.

And since it is through trickery of the sort I described at the beginning of this article that fraudulent mediums flourish and grow prosperous—some, by the way, have become millionaires—I am going to devote the remainder of this article to telling exactly how mediums perform typical tricks. Some of these tricks are so good that I use them myself on the stage. Most of them are so simple that you can learn them without difficulty and employ them to mystify and amuse your friends. Remember, though, that fraudulent mediums do not use them to amuse, but to delude and to defraud.

Many times in the years I have been investigating mediums I have had "spirits" walk on my shoulders or head, or heard their footfalls on the table before me, or

on the walls, ceiling, or floor of the seance chamber. Of course, the mediums in all these cases didn't have expert acrobats as confederates, as I had when I performed an original version of the same sort of materialization in England. Acrobats aren't necessary. The medium, or a confederate, gets out of the circle, takes off his shoes and slips his hands inside them. Walking about in his stocking feet, he touches the bodies of the sitters with his shoes or imitates the sounds of walking.

THE same method is used also by spirit fakers in performing a feat of "levitation," which, in the language of spiritualism, means lifting or elevating tables, chairs, or other objects, or human bodies, supposedly with spirit aid. The medium

places the shoe inside which his hand is in the hand of one of the sitters. Then he raises the shoe. The sitter, quite naturally, imagines the shoe to incase a foot, and the foot to be part of a human body. Consequently when he feels the shoe rise, he believes the medium is being raised and carried about by spirits.

Another shoe trick, not very common because it cannot be performed without long, arduous practice, I have illustrated in one of the photographs that accompany this article. This is a trick that I use regularly on the stage. The medium sits at a small table, opposite the sitter. The latter holds or covers the medium's hands and places his feet on the medium's. It would appear that the medium could release neither hands nor feet without the sitter's becoming aware of it.

One of the medium's shoes, though, is constructed with a strongly braced toe and instep. The bracing permits the medium to slip his foot out of the shoe without the sitter's knowledge, for the latter can notice no difference in the "feel" of the medium's shoe beneath his foot, whether the medium's foot is in or out. Through practice I have taught myself to use my toes almost as well as I can use my fingers. I can write with them, pick up and ring bells, shake a tambourine, pinch the sitter's leg, tie knots in a handkerchief, and perform similar tricks. A fraudulent medium who could do the same would have little difficulty in convincing a sitter that he was able to summon spirits beneath the table to ring



"Spirit Breath"

How the fake medium uses a rubber tube to blow and play a mouth organ contained in a bowl that is covered tightly with chicken wire



Ectoplasm Turned Out by the Yard

In this photograph Houdini demonstrates how, by purely physical means and trickery, he can produce ectoplasm—that mysterious filmy substance in which spirits are supposed to appear. In his mouth Houdini holds one end of a streamer of exceedingly fine cloth netting which flows back to a luminous face mask held by an accomplice

bells, write on slates, and do other things.

Suppose you went to a seance and saw on the table before the medium a mouth organ or an accordion, placed in a bowl or pan, the top of which was covered with chicken wire, soldered or affixed with sealing-wax to the edge of the vessel. You'd say it was impossible for the medium to play the instrument, wouldn't you, even if he could free one of his hands from the grip of the sitters who held him? You might even believe him if he told you that it was a spirit whose breath produced the plaintive notes you heard.

WELL, as in all cases of physical phenomena of which I have ever heard, the medium is the "spirit" that produces the notes. A little rubber tube, or a straw, thrust through the chicken wire, a little puff of air from the medium's lungs, and the trick is done! This trick is particularly effective if performed with an accordion, because the average sitter is not likely to conceive of an accordion's being played by blowing into it. He always has seen this instrument played by means of the hand bellows. Sometimes the medium, instead of blowing through the tube or straw, will play on another mouth harmonica which he produces from concealment in the darkness. The sitters, of course, assume it is the instrument in the bowl they hear.

A rubber tube or straw can be used also in producing other effects likely to

(Continued on page 150)



# A Revolution in Phonographs

## *Tone Defects Cured in Marvelous New Instrument*



**The Machine with a "Perfect Voice"**

A handsome model of the revolutionary talking machine. The design and construction of the horn outlet has been indicated on the photograph above by our artist

**By Robert E. Martin**

**I**N A large banquet hall in a New York hotel a few weeks ago, the talking machine emerged suddenly from the eclipse it has suffered since the beginning of radio broadcasting and, virtually for the first time since its invention almost half a century ago, presented itself to the world as a real musical instrument, deserving of serious consideration.

While several hundred guests listened in spellbound amazement, from a dais at the end of the room a talking machine did things that no mechanical reproducer of music ever had done before.

It caused the majestic tones of the great organ of the Mormon Temple in Salt Lake City, accompanying a choir of 150, to swell through the hall with almost its original volume. It reproduced the Soldiers' Chorus from "Faust" as sung by a grand opera company. It brought into that room the virtuosity of Cortot on the piano and the magic of Kreisler with the violin. Then, proving its versatility, it ground out dance numbers as interpreted by popular jazz orchestras, and the topical songs of comedians.

In no case was the number played the sketchy caricature of the original which we have become accustomed to expect from the phonograph. One needed only to close his eyes to imagine that

the singers and instrumental performers actually were present in that room, demonstrating their art.

For this marvelous new phonograph reproduces song, human speech, and the sounds of musical instruments with almost perfect fidelity. Gone are the blasts, the screeches, and the tinny "phonographic quality" that always have marred the performance of the talking machine.

**A**LL of these things are made possible through what was described that night as "the first real invention in the talking-machine field since the days of Edison, Bell, and Emile Berliner." This invention, or group of inventions, was developed by engineers of the American Telephone & Telegraph Company and the Western Electric Company, and has been incorporated in the talking machines produced by the Victor Talking Machine Company.

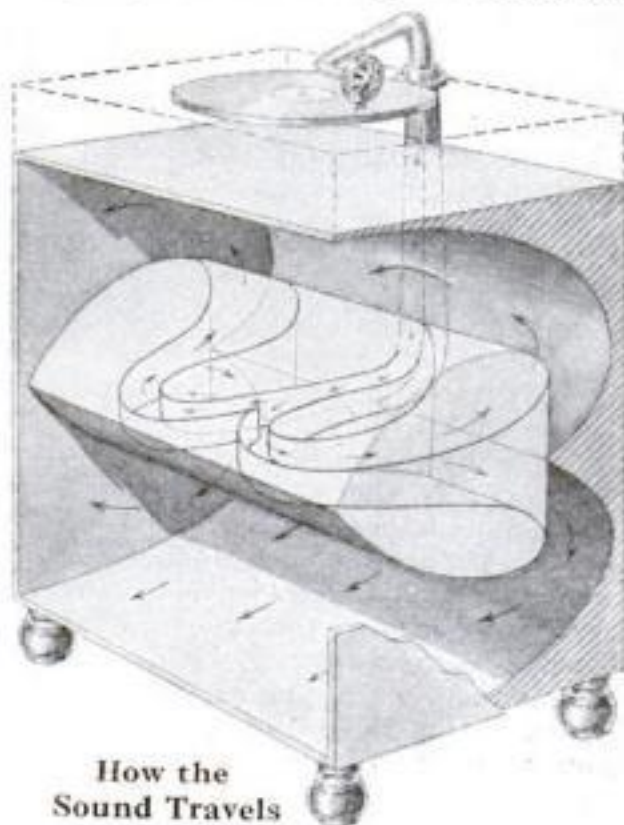
The improvements consist of a new sound box and diaphragm and a six-foot horn, especially constructed to compensate for the distortion previously produced in the sound waves on their journey from the needle to the outer air. This horn is wound about in the cabinet with more twists and convolutions than one would find in a cornet. The bends and turns, however, are not made merely for the purpose of compressing a long horn into a small space.

On the contrary, the device is purposely shaped that way to eliminate defects in sound reproduction. Thus, as the sketch of the horn construction on this page shows, the sound waves passing from the sound box through the tone arm, among other things, are divided vertically and horizontally by knife edges on their way to the horn opening, which occupies the entire front of the cabinet. These

divisions and the odd detours the sound waves are forced to take in their journey comprise an artful method of improving tone quality and volume which the engineers who developed the device learned from their studies of telephone problems.

The familiar mica diaphragm of the conventional phonograph is superseded in the new model by a corrugated diaphragm of duralumin. This and the other refinements made in the sound box play no small part in accomplishing the improvements which the talking machine has undergone.

The purpose of a talking machine diaphragm is to take up the vibrations

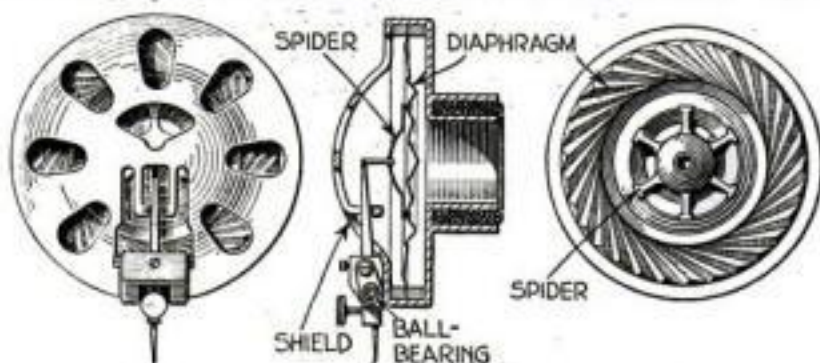


**How the Sound Travels**

A cross-sectional diagram of the new horn. The arrows indicate the course of the sound waves. After leaving the diaphragm and sound box, the sound passes to a vertical knife edge, which divides it in halves. The two sections then pass through a series of convolutions, rejoin, and are again divided, this time horizontally. They rejoin again as they pass from the horn. The intricate construction removes deficiencies in reproduction common to most talking machines.

transferred to the needle from the record so that they may be magnified by the horn into musical sounds or intelligible speech. The mica diaphragm is capable of reproducing sounds whose frequency of vibration ranges from 350 to 3000 a second. This means about three octaves of a piano, or, in other words, the mica diaphragm is incapable of reproducing the very high or very low notes necessary to faithful reproduction of typical music.

The new diaphragm, however, has a range of frequencies between 100 and 5000 a second,  $5\frac{1}{2}$  octaves, or virtually the whole range of speech or music. Likewise, the mica diaphragm had an unpleasant way of vibrating in unison with certain notes. This defect has been eliminated entirely.



**Improved Sound Box and Diaphragm**

Three views of the sound box and diaphragm. The diaphragm is of corrugated duralumin, instead of the ordinary mica. This improvement makes possible the reproduction of a wider range of sound-wave frequencies—a range of  $5\frac{1}{2}$  octaves instead of three as ordinarily. It also eliminates unpleasant "blasts" produced by a mica diaphragm when it vibrates in unison with certain notes sung or played





Chauncey M. Depew



President Coolidge



Elihu Root



John L. Sullivan



Al Jolson

Every one of these famous men reached the top notch of success wearing a hat smaller than the average in size. Chauncey M. Depew, distinguished lawyer, politician, and speaker; President Coolidge; Elihu Root, great statesman; John L. Sullivan, once the mighty man of the prize ring; Al Jolson, noted American comedian—each has called for a  $7\frac{1}{4}$ -inch hat. The average American hat size is  $7\frac{1}{4}$ .

# Why You May Wear a Small Hat and Still Have a Big Mind

Recent Discoveries about Human Brains and the Minds They Hold—How a Famous Woman, in a Strange Bequest, Sought to Throw New Light on the Old Question: Are Women as Smart as Men?

By Arthur Grahame

A FEW weeks ago a brilliant woman died in Washington. When her attorneys opened her will they found she had left her brain to Cornell University for study.

Mrs. Helen Hamilton Gardener, famous as a writer and the only woman United States Civil Service Commissioner, made this strange bequest in the hope of throwing light on the age-old question: Are women as smart as men?

In life she resented hotly conclusions, particularly those of Dr. Edward Anthony Spitzka, famous Philadelphia authority, that women could never become the intellectual equals of men.

In death she proved, at least, that the brain of one exceptional woman is as big as that of one exceptional man; for her brain was found to weigh 1150 grams—exactly the same as that of Dr. Burt G. Wilder, distinguished scientist, who for many years was a member of the Cornell faculty.

And on the heels of this interesting announcement has come widespread discussion of the connection between intellectuality and the size of a brain and the size of the skull that happens to roof a brain.

Will further study of Mrs. Gardener's brain help establish the truth of the old belief that all great thinkers have big brains, and that a man's mental capacity may be judged accurately by the size of the hat he wears?

Probably not. As Oliver Wendell Holmes, who, you will remember, was a great physician as well as a great author, said years ago: "You can't tell by looking at a man's head what kind of a mind is inside it, any

more than you can tell by looking at a safe how much money it contains."

Now and then you hear a man boasting that his head is so large that he has to have his hats made to order, believing obviously that the size of his head indicates a powerful brain. But informed scientists now agree with Doctor Holmes

that this conclusion by no means follows, for the skull does not fit the brain tightly. Enveloping the brain are three membranes, surrounded by a watery fluid called lymph. This fluid gives the brain an opportunity to move about a little in the skull.

So, if your hat size is small, and you feel a swift sense of shame as you whisper it to the clerk, remember that a large head may mean large cranial capacity, but not necessarily a large or a well developed brain. And remember, too, that great men's heads, on the average, are no larger than yours and mine.

The average American wears a  $7\frac{1}{4}$  hat. How does that compare with the sizes worn by his fellow citizens who have achieved fame?

VERY well indeed! Take, for examples, men who have been elected to the Presidency. James A. Garfield wore size  $7\frac{3}{4}$ ; but that did not make him a greater President than Abraham Lincoln, who wore size  $7\frac{1}{8}$ . William H. Taft, an all-around big man, wears size  $7\frac{5}{8}$ ; Grover Cleveland and Benjamin Harrison wore size  $7\frac{1}{2}$ ; and Theodore Roosevelt and Warren G. Harding wore  $7\frac{3}{8}$ —all well above the average. But that doesn't mean that you and I need give up any fond hope we may be entertaining of one day having our mail addressed to the White House. Woodrow Wilson and U. S. Grant both wore the average  $7\frac{1}{4}$ , and President Coolidge wears size  $7\frac{1}{8}$ , slightly below the national standard.

How about prominent public men who did not win the highest prize of American politics? Vice-President



She Gave Her Brain as Proof

Mrs. Helen Hamilton Gardener, brilliant writer and the only woman United States Civil Service Commissioner, who before her recent death bequeathed her brain to Cornell University to prove to scientists that the brain of an exceptional woman is as large as that of an exceptional man



Levi P. Morton wore a  $7\frac{1}{2}$  hat; James G. Blaine  $7\frac{1}{4}$ ; Mark Hanna  $7\frac{1}{8}$ . John Hay, secretary of state and a famous author, wore size 7. Elihu Root, perhaps the most brilliant American statesman of his time, wears  $7\frac{1}{8}$ . William G. McAdoo goes him a split-size better by wearing  $7\frac{1}{6}$ . Secretary of the Treasury Mellon wears size  $7\frac{3}{8}$ .

THE same variation is noticeable in the hat sizes of the famous and successful in other fields of endeavor. John L. Sullivan, mighty man of his hands, whose name became a household word wherever English is spoken, wore a  $7\frac{1}{8}$  hat. James J. Jeffries, almost as famous a ringman in his day, wears size  $7\frac{3}{8}$ . Christy Mathewson, who was baseball's most famous pitcher, wore size  $7\frac{1}{8}$ .

Chauncey M. Depew, who has brains enough to have lived well over 90 years and to have enjoyed them all, also wears a  $7\frac{1}{8}$  hat. Robert G. Ingersoll, one of the greatest of orators, wore size  $7\frac{1}{2}$ ; but so does Harry K. Thaw. Among the men of the stage, Chauncey Olcott wears a  $7\frac{3}{8}$ ; Nat Goodwin wore the same. Richard Mansfield wore size  $7\frac{1}{6}$ ; Joseph Jefferson wore size  $7\frac{1}{8}$ , and George Arliss, John Drew, and Al Jolson all wear size  $7\frac{1}{8}$ . Victor Herbert, the composer, wore a  $7\frac{3}{4}$  hat, and the golden-throated Enrico Caruso a  $7\frac{1}{4}$ .

Some great financiers wear large-size hats; others as successful wear hats of average size. J. P. Morgan, Sr., wore a  $7\frac{5}{8}$ ; Colonel John Jacob Astor a 7; and Charles M. Schwab wears a  $7\frac{1}{4}$ .

Inventors have the same sort of heads—on the outside—as have other people. Cyrus W. Field, of cable fame, wore a  $7\frac{1}{6}$  hat; W. A. Roebling, who built the Brooklyn Bridge, wore size  $7\frac{1}{8}$ ; and Richard Hoe, inventor of the modern printing press, size  $7\frac{1}{4}$ .

THE hat sizes of leaders in war vary as widely as do those of leaders in the paths of peace. General Phil Sheridan, famous Civil War cavalry leader, wore a  $7\frac{1}{4}$  hat; Admiral George Dewey wore size  $7\frac{1}{8}$  and General Pershing wears size  $7\frac{3}{8}$ . The great British Empire some day will be ruled by a king whose crown will be only a  $6\frac{5}{8}$ , for that is the size of hat ordered by the Prince of Wales from an American hatter when he last visited this country. All of which shows that the size of a man's head isn't a trustworthy guide to the value of its contents.

Study of Mrs. Gardener's brain is likely to go a step further and develop testimony favoring the contention that the size of the brain itself has little to do with mental ability. The brain of the average man weighs 48 ounces, and that of the average woman  $43\frac{1}{2}$  ounces. It was upon this difference in weight that Doctor Spitzka based the conclusions that drew Mrs. Gardener's resentment and resulted in her unusual will.

Mrs. Gardener held that such beliefs



#### Taking the Measure of a Head

Here is a remarkable contrivance often employed by hat stores in measuring quickly the exact size and contour of the customer's head. The circle of hinged bars automatically adjusts itself to the form of the head. When the lid at the top is lowered, the contour of the head is stamped accurately on a sheet of paper

were unfair to her sex because Doctor Spitzka and other scientists have examined 10 times as many men's brains as women's and because most of those examined were of men of exceptional mental attainments. The women's brains studied all were those of unfortunates who died in free wards of hospitals or prison.

And for support of Mrs. Gardener's contention that women are the mental equals of man one only need turn to the reports of psychologists who have been busy studying the living, working brains of men and women and boys and girls.

At Pacific Union College in California,

for example, Prof. L. M. Terman tested 132 young men and 100 young women. The men's records averaged but 2 per cent better than did the women's. At the University of California he gave a general intelligence test to 1182 freshmen, and again found the sexes to be about equal.

The general psychological test that was given to 2,000,000 men in the army during the war has been repeated on high school and college students of both sexes in many parts of the country, with approximately the same results.

Even more convincing was the test made by Edward L. Thorndike, professor of educational psychology at Columbia University. He selected 10 pairs of twins, carefully tested each boy in comparison with his sister—and found them evenly matched in intelligence.

Doctor H. B. Thompson, of Chicago University, selected 25 young men and 25 young women of equal scholarship and social situation, and gave them a very severe test. When the results were tabulated, it was found that there was but a slight difference between the sexes. European scientists tested a large group of brothers and sisters, and found that boys and girls were mental equals.

ANOTHER interesting feature of nearly all of these test reports is that they show that the highest and lowest marks are made by men, while women cling more closely to the average of ability. While there are more brilliant men than there are brilliant women, there also are more flat failures.

Brains weighing more than 60 ounces are not uncommon. While scientific study seems to have proved that normal intelligence is impossible with a brain weighing less than 32 ounces, there is no proof that an exceptionally heavy brain is a more efficient piece of thinking apparatus than a comparatively light one. The brain of Turgeneff, the Russian novelist, weighed 74 ounces and is the heaviest ever examined; but the brain of William Makepeace Thackeray, who as a novelist stands at least as high as Turgeneff, weighed 58.6 ounces, while the brain of Walt Whitman, the American poet, weighed only 45.3 ounces.

Joseph Bouny, a famous French jurist, had the second heaviest brain on record, weighing 68.5 ounces, but Napoleon Bonaparte managed to conquer most of Europe with a brain weighing only 53.1 ounces. Charles Babbage, a great English mathematician, and Baron Liebig, a famous German chemist, did remarkable work with brains of only average size.

There seems to be a closer connection between the size of a man's body and the size of his brain than there is between the size of his brain and the power of his mind. Examination of thousands of brains by scientists seems to indicate that although tall men usually

(Continued on page 149)

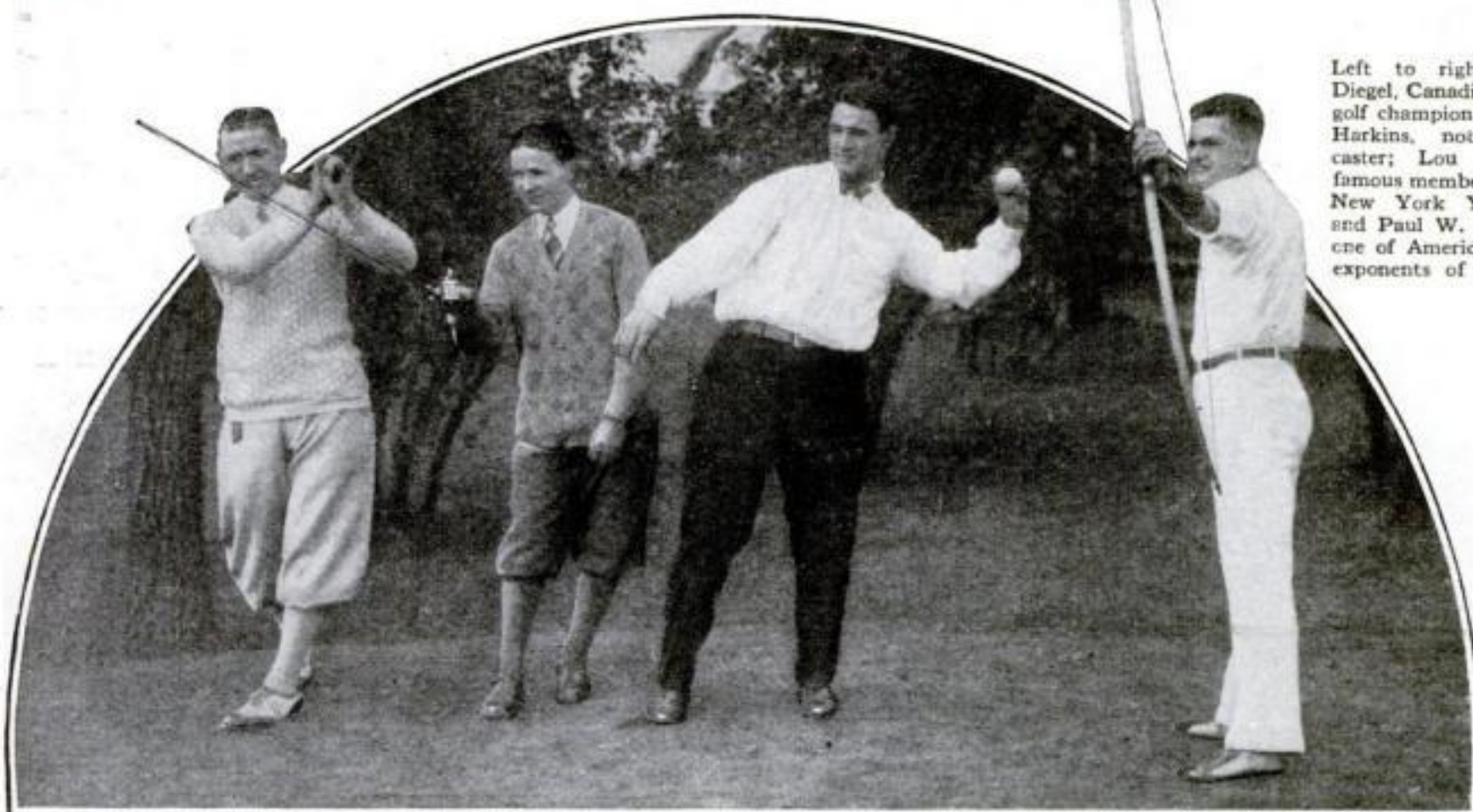


#### Great Men with Large Hats

Theodore Roosevelt (top) wore a  $7\frac{5}{8}$  hat; Gen. John J. Pershing takes a  $7\frac{3}{8}$  hat, and William H. Taft,  $7\frac{5}{8}$ . Scientists hold, however, that the large brain power of such men is not due to the size of the head, but to the brain quality



# A Four-Sport Golf Match



Left to right: Leo Diegel, Canadian open golf champion; Edwin Harkins, noted fly-caster; Lou Gehrig, famous member of the New York Yankees, and Paul W. Crouch, one of America's best exponents of archery

## Ball Player Outpoints Golfer, Angler, and Archer

ON THE course of the Belleclair Country Club at Bayside, N. Y., a few weeks ago, four men played what was probably the most remarkable golf match that ever took place.

The contestants were Leo Diegel, Canadian open golf champion; Lou Gehrig, left-handed first baseman of the New York Yankees; Edwin Harkins, well-known fisherman and fly-caster, and Dr. Paul W. Crouch, one of America's best archers.

In one sense, only Diegel played golf. That is to say, he was the only member of the foursome who used regulation golf clubs to knock a regulation golf ball from tee to green. The other contestants used the implements of the sport in which each has achieved fame. Gehrig threw a baseball. Harkins cast with trout rod and reel. Doctor Crouch shot arrows from a bow. Each throw of the baseball, however, each cast of the fly, and each bolt sped from the bow was scored as a golf stroke, the man making the lowest number of strokes in completing the course being adjudged the winner.

Now, you'd imagine that Diegel, the golfer, would easily prevail in such a match. That, though, is not the way it turned out. Gehrig, the baseball player, won the match by a single

"shot," negotiating nine holes in 32 throws. Diegel and Doctor Crouch, the archer, were tied for second place, each turning in a card of 33. Harkins, the angler, was a bad fourth, with a score of 45.

Probably the most surprising thing about this freak match is that the baseball player won. Lou Gehrig, like any other big-league player, can throw a baseball, of course, with amazing accuracy. Yet both Diegel, the golfer, and Doctor Crouch, the archer, "outdrove" Lou Gehrig almost three to one, a fact which one would expect after consulting the records in the three sports. For the longest throw that a man ever made with a baseball was 426 feet, ac-

complished by Sheldon Lejeune, a minor-league player, in an exhibition in the Middle West several years ago. On the other hand, a golf ball that Abe Mitchell, noted British professional, drove at the North Foreland Golf Club in England not long ago, struck the ground 915 feet from the tee, and C. D. Curtis, an archer, shot an arrow 918 feet 4½ inches in a competition at Pembina, N. D., last year.

HOWEVER, when it came to making his "shots" count, Gehrig's long practice at putting a ball where he wanted it to go stood him in good stead. His "approach throws" landed dead to the pin. When he attempted to hole out, he tossed the ball to the mark without a miss.

So Gehrig's never-failing marksmanship sufficed to counterbalance the longer shots made by golfer and archer. Then, too, since he could pick up the ball from any lie, traps did not cause him the trouble that a golfer experiences.

As for Harkins, the fly-caster, he trailed the field from the outset. Armed with a light trout rod, his chance for obtaining distance was comparatively nil. The longest cast ever made with a rod of the kind he carried was 131 feet eight inches, by G. G. Chatt, of the I. C. Casting Club, C. in 1918.



How the modern Robin Hood, Dr. Paul W. Crouch, "holed out" on the green, speeding an arrow into the bull's-eye of a target above the hole. He tied for second place



CARL E. AKELEY with a lioness brought down during his last expedition in African jungles. Akeley not only is a famous big-game hunter, but is one of the world's greatest naturalists and taxidermists, an inventor, sculptor, author, and lecturer



# He Killed a with His

By  
Hawthorne  
Daniel

this article appears, he and his wife will be on their way again to this land that to Akeley is the most beautiful in the world, where he feels more at

home, perhaps, than many of us do in the crowded city.

His thrilling bare-fisted combat with the leopard, he recalled, occurred during his first trip to Africa, early in his career, and it was due largely to his inexperience in the jungle.

ONE afternoon, accompanied only by a single native, he started out from camp to hunt. He had not gone far when he saw what appeared to be an excellent specimen of hyena. He fired at and killed the animal. Approaching it, however, he found it was badly diseased, and so unfit for his purposes of preservation.

He left the carcass where it lay, and went on. He had gone but a little way when he spied a fine wart-hog, which he shot. The specimen was a very good

A GRAY-HAIRED, mild-mannered, soft-voiced man sat in his New York studio recently and in the matter-of-fact way in which one might describe the details of a summer vacation told me how, with his bare hands, he once fought a wounded, snarling leopard to the death in the heart of African jungles. With no more suggestion of heroics than might be incidental to a discussion of the latest book, he told me how, his left hand clutching desperately at a hairy throat, his right arm caught and torn in the grip of savage jaws, he managed to ram the fist of his injured arm with all his might into the ferocious animal's gnashing mouth.

"We were both getting weak," he was saying, "and at last we went down. Luckily the leopard was underneath, and as we fell my knees struck his chest, and I heard a rib snap. That gave me an idea, so I jumped up and down on his chest with my knees, while I still held his throat with my left hand, and held my right hand in his mouth. I caved his ribs in, and finally he gave a gasp and released his hold."

IF THE victor in such a thrilling jungle combat had been some towering young giant with heavy frame and bulging muscles, I still would have considered the outcome quite remarkable. The story of Samson tearing the lion's jaws always has fascinated me. But the man I saw before me there in the quiet of the New York studio was far from being a Samson. In age he is past the mark of three score years. His hair is iron gray, his shoulders round, and his frame slight and wiry.

And yet, knowing Carl E. Akeley as I do, knowing of his record of tremendous achievement, I can understand why it was that the leopard, locked in death grip with this man, met more than his match.

For Akeley has established himself as one of the most remarkable Americans of

his time. No man that I know of can equal his amazing versatility. He is one of the world's greatest naturalists. Certainly he is the world's greatest taxidermist, for it was he who raised the mounting of animal specimens for exhibition to the level of the arts. As an inventor, he gave the industry the cement gun, and he devised the famous Akeley motion-picture camera, capable of work that no other camera can perform. He is a sculptor whose work art critics rank with the best. He is an author, a lecturer. His exploits as a big-game hunter are known throughout the world.

Despite the unremitting toil necessary to his tremendous accomplishments in so many diverse fields, despite his numerous adventures, and a succession of frightful experiences such as those he related to me, Akeley today looks and acts far younger than his 61 years. He still has the appearance and the buoyant spirit of youth. He is sinewy, vigorous, able to hold a great, double-barreled elephant gun to his shoulder and withstand the recoil of two gigantic charges of death-dealing cordite.

It was while discussing his plans for his fifth visit to Africa, for the purpose of studying wild animals and collecting specimens for the American Museum of Natural History in New York City, that Akeley told me of some of his narrowest escapes from death in the land of adventure. Shortly after



The Charge

A remarkable photograph of a wild elephant charging. It was such an animal that attacked Akeley and left him for dead



# Savage Leopard Bare Hands!

*Amazing Adventures  
of Carl Akeley, the  
Greatest of Animal  
Experts--His Narrow  
Escapes from Death*

one, so he marked the spot, planning to pick it up on his return to camp.

For the rest of the afternoon he had no luck. At dusk he returned empty-handed to get the wart-hog. A blood-stain on the ground showed him he was at the right spot, but no other sign of the animal was to be seen. Then he heard a sound in the bush near by, and saw a hyena dragging the half-devoured wart-hog away.

**S**OMEWHAT disgusted with hyenas in general because of losing his wart-hog, Akeley continued toward camp. On his way he passed the carcass of the hyena. As he neared it he saw a form slink away and disappear in the dusk behind a bush. The light was so poor that Akeley could not see what kind of animal it was, but he raised his gun and fired at the bush. That the bullet had reached its mark was obvious from the snarl he heard. It was the snarl of a leopard—one of the most vindictive of all animals of Africa, and one that will fight furiously.

Knowing what he had to contend with, Akeley decided to play safe, for it was growing darker, and he could not see to fire accurately. He started off for camp, keeping well clear of the bush behind which the leopard had disappeared, and followed by his negro "boy." A dry stream-bed, called in East Africa a "tug," lay across his path—a "tug" with abrupt sides six or eight feet high, and with a flat, sandy bottom. Into this Akeley and the "boy" dropped, and when they had crawled up what they thought was the other side, they found themselves, instead, on an "island" that rose from the sandy stream-bed.

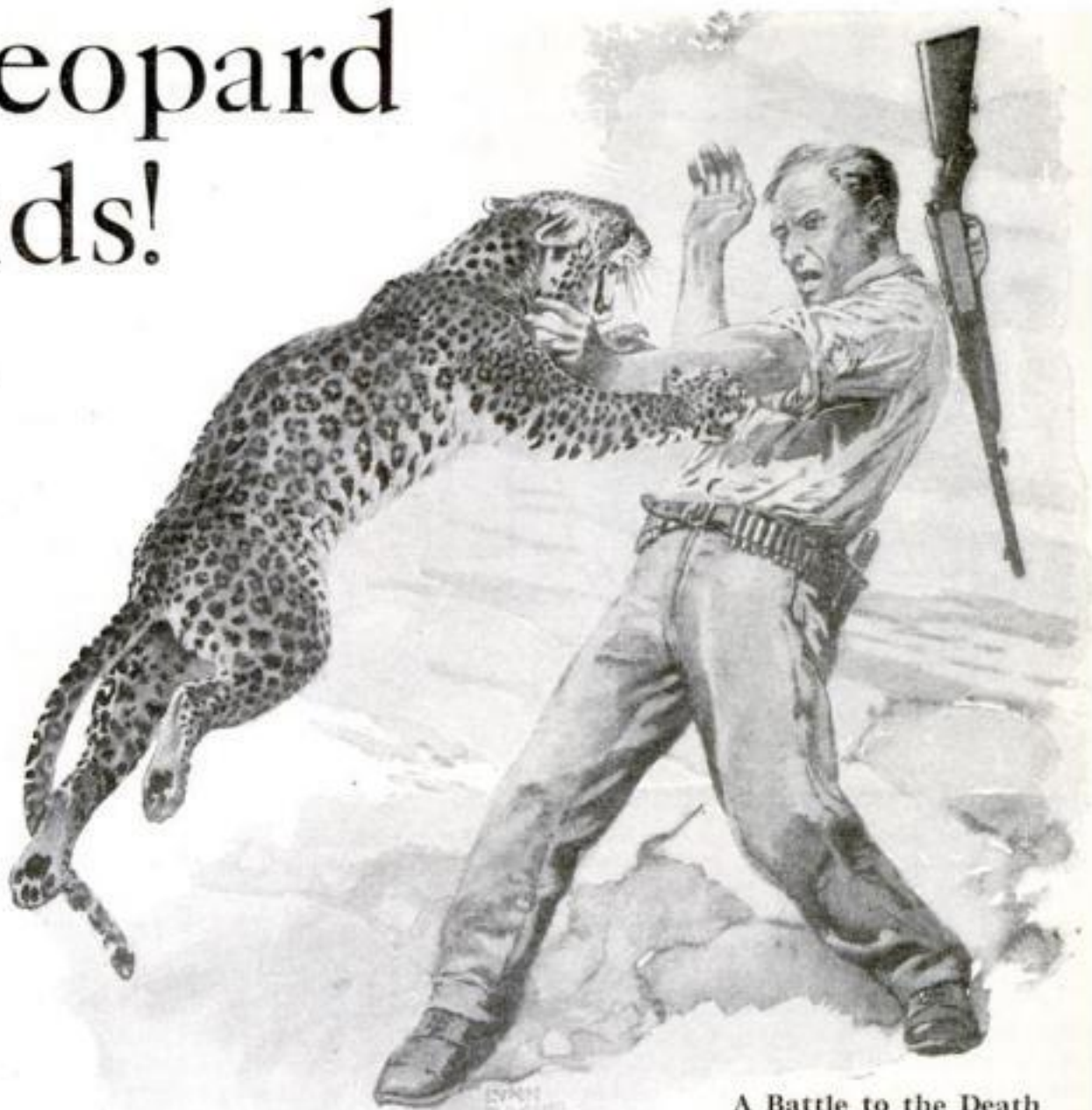
The hunter was still interested in knowing just what had happened to the leopard, so he walked to the end of the island, which came to a sharp point, to take another look in the direction of the bush. Gazing into the dusk, he saw an object crossing the white, sandy bottom of the stream-bed. The leopard had left the shelter of the bush, and was making its way on a course that was roughly parallel to that which Akeley had taken, and about 20 yards away.

Evidently the beast was out for trouble,

so Akeley raised his gun, aimed as carefully as he could in the gathering night, and fired. He saw a spurt of white in the sand over the leopard's back, and knew that he had missed. Again he fired, and again he saw that spurt in the sand. A third time he aimed and pulled the trigger. A flame burst from the muzzle of the gun, and the leopard stopped. The "boy" started to sing his native song of triumph, but it was interrupted by a scream from the leopard that told all too plainly that it had commenced a charge.

I never have seen a wild leopard in a charge, but Akeley once showed me a motion picture of one charging a group of native spearmen, and he had to run the picture twice before I could make out definitely the streak that marked the motion of the animal. It seems almost impossible that any animal can move with such amazing rapidity. And here was one of those beasts, flashing across 20 yards of open sand, toward the tip of the "island" on which Akeley was standing, six feet or so above the approaching animal.

**H**E WORKED the bolt of his rifle hurriedly—the magazine was empty! And the furious beast was scrambling up the side of the bank. Akeley, realizing that he had to load, and that he would not have time to do so if he stood still, dropped down the other side of the "island's" point, and ran up the bed of the "tug," loading as he went. He had gone 10 or 15 yards by the time the gun was loaded, and he whirled to fire—just



A Battle to the Death

Before Akeley could pull the trigger, the great cat was upon him. The gun went flying from his hands, and the leopard seized his right arm in its powerful jaws

too late! The great cat was in the air as he turned, and before he could pull the trigger, 80 pounds of pain-maddened leopard was on him!

The gun went flying from his hands, and the angry cat seized his right arm in its powerful jaws!

**A**NY one who has tried to hold an ordinary tabby-cat when the cat didn't want to be held, will be able faintly to visualize what Akeley was facing, with a clawing, biting, snarling beast chewing his arm, and scratching in every direction with claws wide spread.

An attacking leopard attempts, when it springs, to seize its enemy by the throat. Then, while holding on with teeth and front feet, it draws up its powerful hind feet, and with one tremendous thrust tries to disembowel its victim.

But Akeley had been fortunate. His first shot had broken one of the leopard's hind feet, and that had thrown the animal just a bit off on its spring. Then, after the animal had launched itself, Akeley had turned, so that it was his right arm, and not his throat, that the leopard now was chewing on. Furthermore, the leopard's hind feet had swung past the mark, and were more or less out of the fray, for the cat was using them in the shifting sand to try for a foothold.

Akeley grasped the leopard's throat with his left hand, and by keeping his arms inside the animal's front legs, prevented the terrible claws from doing more than shred his shirt. But the leopard was chewing his arm ferociously and





### A Hunter-Artist's Masterpiece

The great elephant group in the American Museum of Natural History—a masterpiece of Akeley's wonderful skill and artistry in mounting animals. Even larger than the huge bull elephant at the center of this group was the one that attacked Akeley, pinning him to the ground

slashing constantly with its fore paws.

"I felt no pain," Akeley told me, "but I certainly never thought for a moment that I was going to come out alive. I was rather calm, as a matter of fact, except for a tremendous and wildly pleasant thrill I felt, knowing that I was battling for my life. I remember very clearly thinking of a conversation I once had with a friend when, at the World's Fair at Chicago, we had seen a statue of an Indian fighting a bear, very much as I was fighting this leopard. We wondered if the man felt any pain. 'Well,' I thought, 'I could tell him now. But I won't have a chance.'

"With my left hand at the animal's throat I pushed him down my right arm, for he was chewing all the time. I dragged my whole arm through his jaws, and finally I got my right fist in his mouth."

Then followed the terrific final struggle, as related at the outset, in which Akeley, grappling with the weakened animal on the ground, battered its ribs until it released its hold upon him, and at last lay gasping and helpless.

"I GOT to my feet and called the boy," he went on, "and then the leopard gave some signs of life, and I asked the boy for his knife. He had thrown it away in his fright, but he found it again, and I made sure, this time, that the animal was dead.

"I was weak, but I didn't know how weak until I tried to shoulder that leopard and carry it to camp. I couldn't make it. And then a thought struck me that made me waste no time.

"That leopard had been eating the horribly diseased hyena I had killed. Any leopard bite is liable to give one blood poison, but this particular leopard's mouth must have been exceptionally foul. So I headed for camp, and demanded all the antiseptics that were to be had. They pumped the antiseptics into the innumerable teeth wounds until my arm

was so filled with the liquid that an injection in one place drove it out of another. That treatment was far more painful than the fight had been, for the nervous excitement had worn off, but it was applied so soon that blood poison never appeared."

That evening the leopard was brought in to camp, and it was found that two of Akeley's bullets had scored. One had, as I said, broken the bones of one hind foot, while the other had made a superficial flesh wound at the top of the leopard's neck.

I have known Carl Akeley for a number of years, and yet I never see him that I am not interested in his adventures. He can tell of his experiences with the utmost modesty, and his most exciting stories are related in a quiet tone that makes them most impressive.

ON AKELEY'S smooth-shaven cheek is a little scar—hardly noticeable now, that is a reminder of one of his most tremendous adventures, in which a furious and gigantic bull elephant left him for dead high on the side of Mount Kenya, in British East Africa.

This beautiful mountain, that rears itself far above the snowline almost directly on the Equator in Kenya Colony, is a favorite haunt of elephants, for among the countless hills and valleys that make up the lower slopes are food and water, open spots, jungles and bamboo thickets, game trails, and everything that an elephant wants in life.

Halfway up the side, Akeley and a group of 14 negro "boys" were following

the trail of three big elephants. Of the three, one far surpassed the others—surpassed, Akeley says, any other elephant he ever saw. Those of you who have seen Akeley's giant bull that is the center of the elephant group at the American Museum of Natural History will realize what this means, for the one he followed that day, along the slopes of Kenya, was greater still.

For hours they held the trail, and when night came they camped, setting out once more in the morning. By noon they reached an opening, where fresh signs of the animals were found, so they pushed on. It was cold, high on the side of the mountain, and a drizzle began to fall. Suddenly the loud crack of a broken branch sounded near them in the jungle, and the party knew they were approaching their quarry.

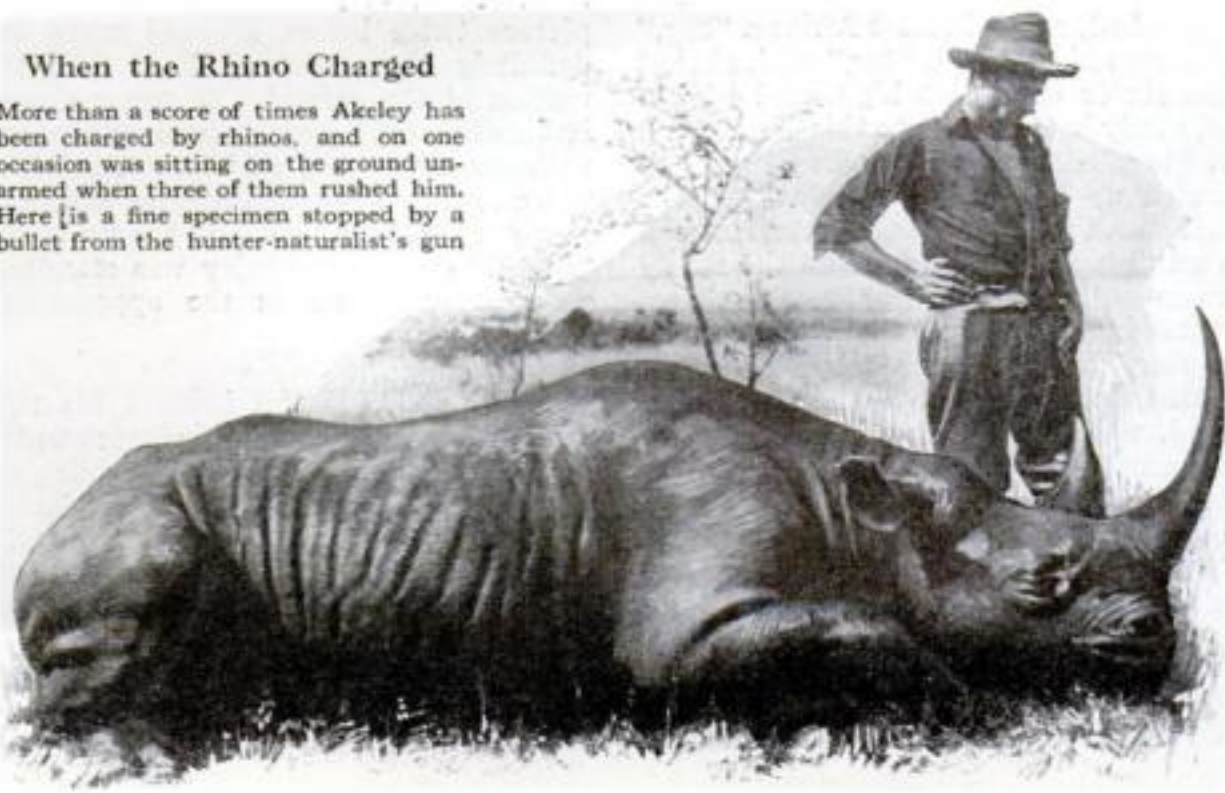
ONE negro went ahead to a bend in the trail and signaled the direction the elephants had taken. Akeley paused to rub his cold hands so as to be able to use his trigger finger quickly, and was standing in the trail examining the steel-jacketed bullets from his bandolier as his gun-bearer handed them to him, when suddenly he was vividly aware of the fact that an elephant was almost upon him. The old giant had got tired of the pygmies on his trail, and had carefully turned about in the thick jungle. Akeley heard no sound of warning, but that is not surprising, for elephants can travel through the jungle with as little noise as a rabbit can run across the prairie.

"I only remember," he told me, "that suddenly I knew an elephant was almost upon me, and that I picked up my gun and wheeled about, trying, as I turned, to shove the safety catch up. It would not budge. I remember thinking that perhaps I had left it released, and that even if I hadn't left it so, I must pull both triggers just the same. Of course I couldn't fire the gun if the catch were not released, but I thought I had to, anyway. I didn't get a chance to try. Something struck me heavily in the face and dazed me. Then I saw a great tusk aimed directly at my chest. I grabbed it with my left hand, and grabbed the other tusk with my right, and swinging in between them, I went down on my back.

(Continued on page 156)

### When the Rhino Charged

More than a score of times Akeley has been charged by rhinos, and on one occasion was sitting on the ground unarmed when three of them rushed him. Here is a fine specimen stopped by a bullet from the hunter-naturalist's gun





# They Can See *with Their Skin*

## *Blindfolded French Girls Read Books to Prove Amazing Power*

By G. B. Seybold

**M**ANY times there had come to the attention of Jean Labadie, noted French scientist, the cases of men and women who claimed the uncanny ability of seeing while blindfolded; and in each case the claimant had proved to be a fraud. So it was with two grains of salt that he read, a few weeks ago, the report of a young woman of Paris who demonstrated the strange power that scientists call "paroptic vision."

In this case, however, a group of doctors in the Paris Hospital had testified that the young woman, Mademoiselle C—, actually was able to read through the skin of her face, with her eyes covered. If she were a fraud, she must be clever, Labadie decided, so he got permission to test her himself.

He took the utmost precautions to close her eyes. Then he went into a dark room and with his hands in a black box, tore off at random a sheet of a calendar pad. Without seeing this himself (for he wanted to do away with the possibility of unconscious telepathy) he showed it to the young woman.

"What do you see?" he asked.

"It is a sheet of a calendar," she said. "It is the twenty-ninth of July."

Labadie looked at the paper. To his amazement,

she had "read" correctly.

Then he took a small wooden box and removed the lower half of one side. On the lid he attached an electric light so that it illuminated a playing-card laid flat on the bottom of the box.

He held this box before the young woman so that her bandaged eyes were on a level with the bottom of the box. Any light rays from the card could not possibly reach her eyes in a direct line.

"Do you see anything now?" Labadie queried.

"Yes, it is a playing-card—the three of diamonds."

Once more she was right. Seemingly the only explanation was that she had seen the card through the skin of her forehead.

Now profoundly interested, Labadie applied similar tests to three little girls living in Nay,

in southern France, 11, 13, and 14 years old, who were reported to have even more remarkable powers. He found they could read pages of books opened at random, thread needles, and detect colors of cloth without using their eyes.

In some of the tests a picture or other object was fastened to a rack in

front of the child, while an ingenious shielding device shut out all rays of light from the object to be identified. Yet in every case the object was described accurately.

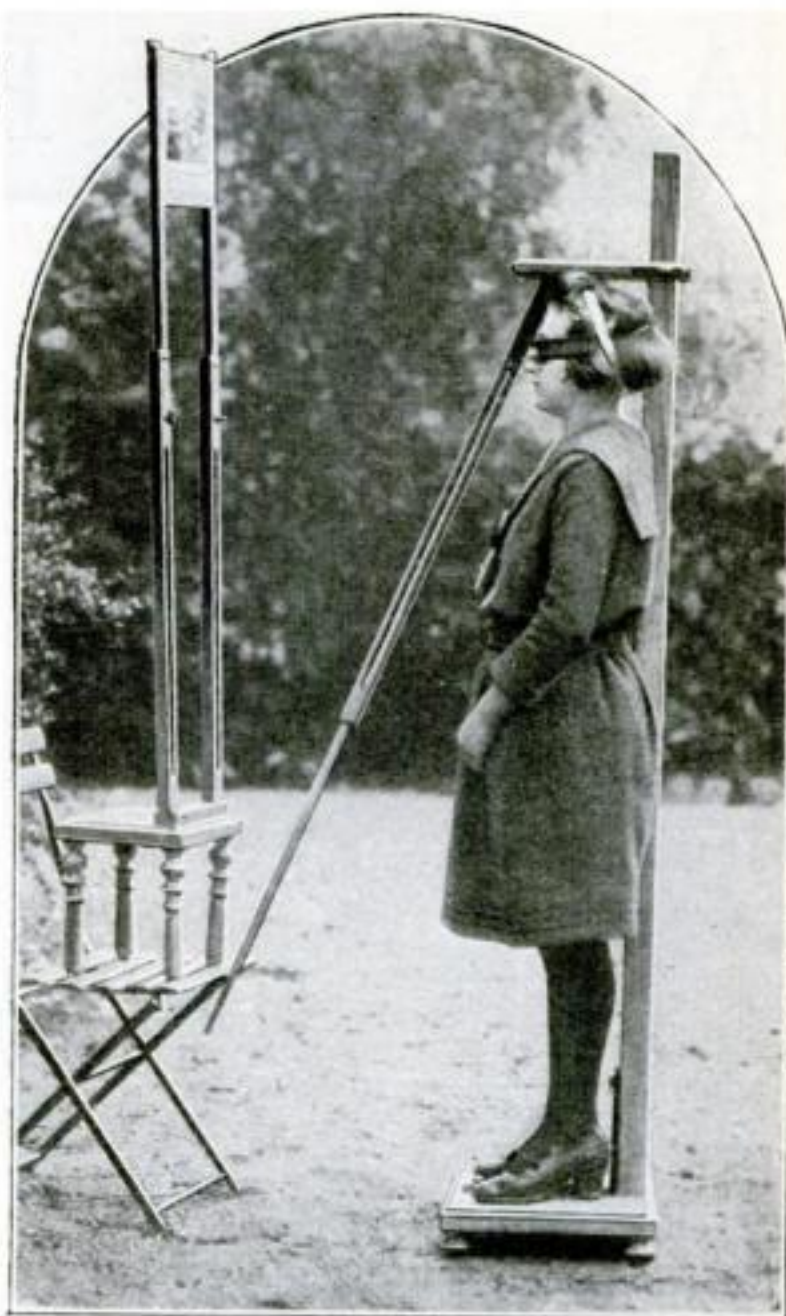
How was it done? Labadie does not pretend to know, but gives some interesting observations.

Aside from the eyes, the most sensitive part of the body for seeing, he says, is the skin of the face, especially the forehead.

**T**HE girls he tested took considerable time to identify objects, and could retain the vision only with utmost concentration. The whole process was an exhausting mental strain.

A surprising thing was that the line of vision seemed to differ from that of ordinary sight. When the subject tried to pick up an object seen through the forehead or chin, she put her hand to one side of the object, indicating that it was not "seen" in its true direction.

Labadie does not believe there is, necessarily, a special organ of paroptic vision in the skin. It is merely some peculiar sensitiveness of the skin nerves, which receives impressions of light and conveys them to the brain in the form of definite images. M. Labadie believes sincerely that he precluded the possibility of trickery in the cases that he studied, but awaits further investigation to find a scientific explanation of the phenomenon.



**Blindfolded, She Still Sees**

One of the tests in which a 14-year-old French girl, blindfolded, described accurately a picture completely shut off from her line of vision by this oddly arranged apparatus



**Girls Read without Aid of Eyesight**

With eyes covered, these French girls demonstrated the remarkable ability of reading pages of books opened at random, or of describing objects such as playing-cards and calendar pages



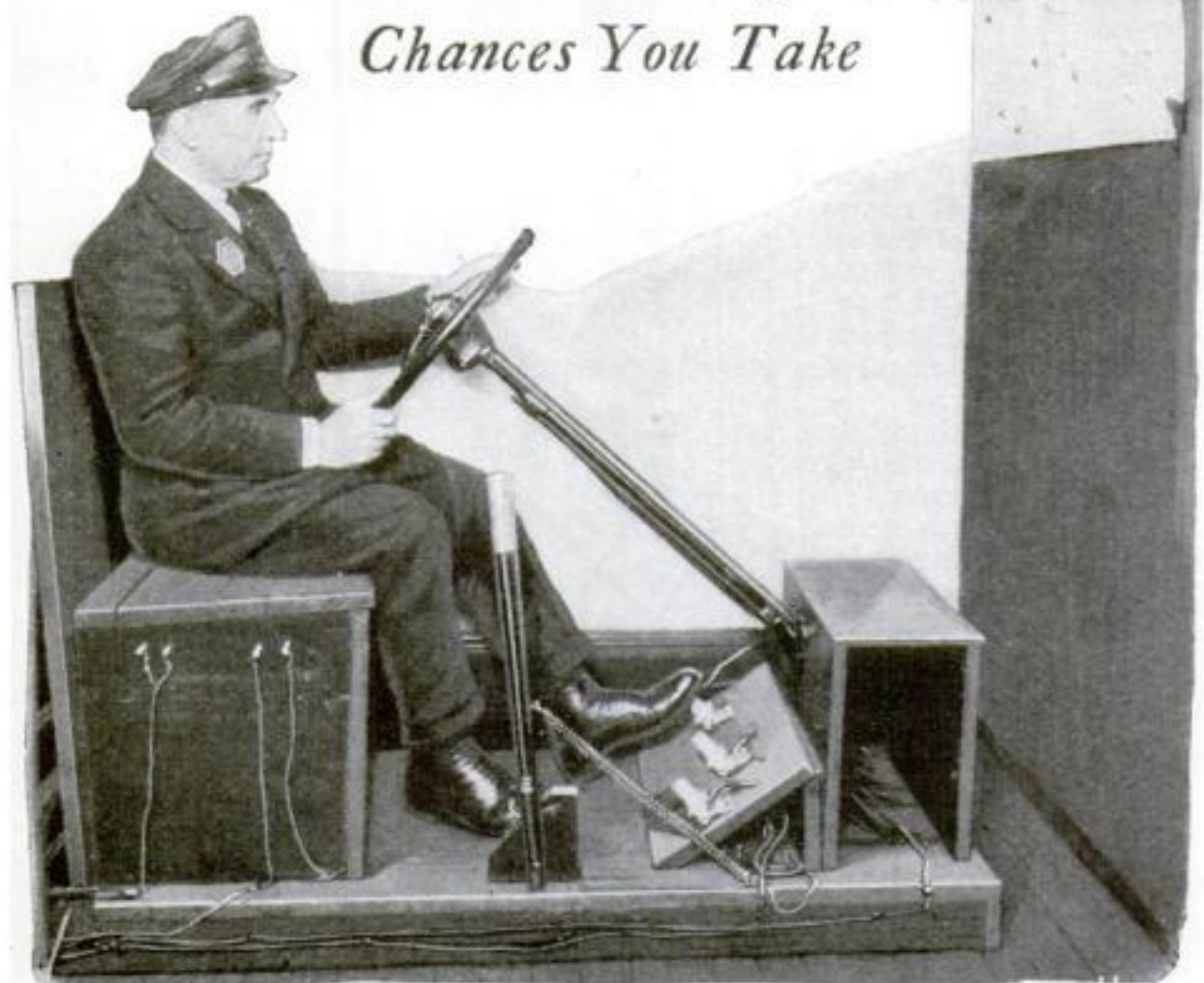


# Are *YOU* Fit to Drive a Car?

*How to Test Yourself—Why  
Best Drivers Are Neither  
Dull nor Too Bright—  
Chances You Take*

By

Frank Parker Stockbridge



A Driver's Fitness Measured in 15 Minutes

This remarkable "dummy" car has been used effectively to test hundreds of drivers in New York City. Clutch and brake pedals, foot throttle, and emergency-brake lever are connected electrically with an ingenious instrument that automatically records the driver's reactions to warning lights of various colors, flashed on the board in front of him. In 15 minutes the machine tells whether the driver is fit to operate a car.

**A**RE you fit to drive a car, or do you take your own life and that of others in your hands every time you step on the starter?

Don't get sore at the personal question. You've got plenty of company. There are 20,000,000 persons driving cars in these United States and 10 per cent of them or, say, a couple of millions, haven't any more business to be driving than a rabbit has to pick a quarrel with a pack of beagles. Among them, these unfit drivers succeeded in killing more than 20,000 Americans in the last year and maiming nearly 500,000 more. Their "bag" will be bigger in the coming year, because there will be more cars in use.

Are you one of these potential assassins? . . . Yes, that's what they all say. You mean that you haven't killed anybody yet. But how many fenders have you smashed? How often have you just missed a telegraph pole or a fire plug? How many times have you done some fool thing like trying to pass another car on a curve or going up a hill, running in trolley tracks, crossing a railroad in high, speeding on wet pavements or "cutting corners?"

Perhaps you're not as fit to drive as you think you are. If you're not, however,

it is not necessarily a reflection on your intelligence. For one of the curious things that has been discovered by the psychologists who have been investigating the causes of motor accidents and the fitness of drivers, is that there is such a thing as being *too* intelligent to be a good motorist.

Here's another interesting fact, which may help you to answer the question of your own fitness to be driving a car: If

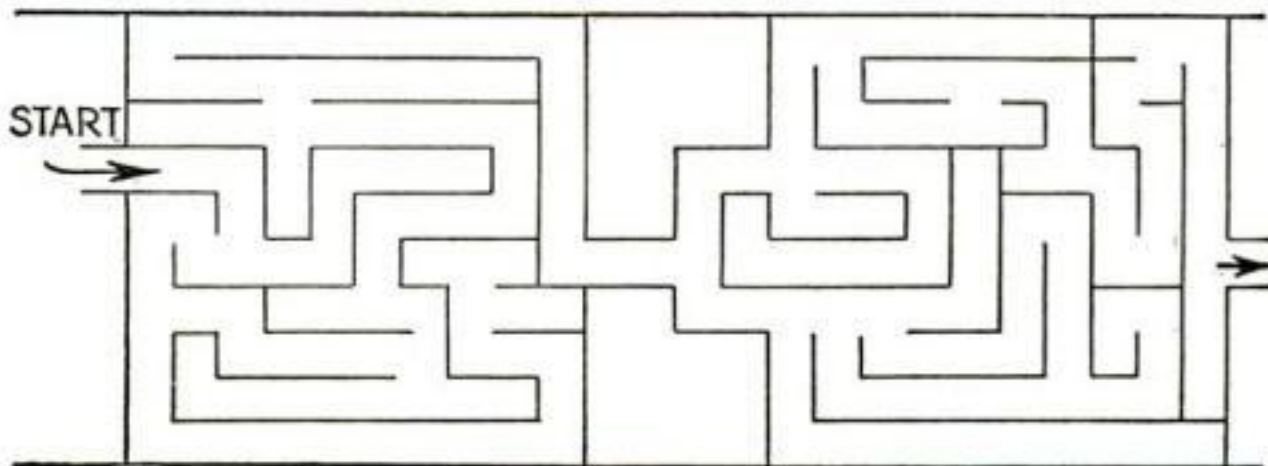
you've been driving for any considerable time and haven't had an accident yet, the chances are several to one that you won't. But if you're one of the "un-lucky" drivers, always having close calls and minor accidents, there's an excellent chance that you'll have a serious one some day.

How to reduce the number of motor accidents is such a serious problem that Herbert Hoover, a few months ago, called a national safety conference to consider it. The consensus of opinion was that one way would be to eliminate the unfit drivers, and the question of how to determine that a driver is unfit (before he proves it by killing somebody) was put up to a committee of psychologists, who have been at work, in New York, Washington, and elsewhere, devising and trying out tests intended to reveal driving unfitness in advance of actual experience.

**"WE CAN** tell in 15 minutes whether a man or woman is fit to drive an automobile without serious danger of accident," said Dr. David Wechsler of the Psychological Corporation of New York, one of the scientists co-operating in this work. "Our tests have been applied in the examination of hundreds of chauffeurs, including the employees of one of the large taxicab companies, and the results obtained tally exactly with the experience of the men themselves, as shown by their employers' records."

Doctor Wechsler's tests are of two kinds. One is a general intelligence test, similar to the now familiar Army "Alpha" test, with some adaptations and improvements to make it more directly applicable to drivers; the other is an ingenious "practical" test, which is the more important of the two.

"Of course, it goes without saying that a certain degree of intelligence is essential to safe driving. It is comparatively easy to weed out those below the minimum requirement," said Doctor Wechsler, "but not so easy to eliminate the ones who are super-quick. Their very keenness makes them daring and consequently careless.



How Quickly Can You Find Your Way through This Maze?

Beginning at the arrow marked "Start," find your way out to the arrow at the other end without going up any blocked paths and without crossing any lines. According to the latest psychological tests, you should be able to do this in less than two minutes.



The very best drivers are those who are neither stupid nor extra bright."

The practical test, which determines the prospective driver's carefulness, his alertness and quickness of reaction, is given by means of a "dummy" car, set up in the laboratory. Clutch and brake pedals, foot throttle and emergency brake lever are connected electrically with an ingenious recording instrument, and in front of the subject is a board on which there are electric-light bulbs of different colors. These are connected with an automatic make-and-break device, which, operating at a fixed speed, lights the bulbs in a predetermined rotation.

THE driver takes his seat behind the wheel as if he were about to start out with a car. His left foot is placed on the floor, his right on the accelerator. He is instructed that under no circumstances is he to "step on the gas," as that is being fed at the proper rate. Then he is told that certain colored lights on certain sections of the board in front of him are signals of different kinds, in answer to which he must do certain things.

For example, a yellow light flashing on the board means "slow up." The driver must instantly jam down hard with both feet, on the clutch and brake pedals, then release them to be ready for the next flash. If he does not do this before the yellow light goes out, it is automatically counted as an error. There is just four-fifths of a second within which he must perceive the yellow light, mentally interpret its meaning, and take the action the situation calls for. If he does this correctly, the recording instrument sets down a mark in his favor. But if, in replacing his feet to their former position, he forgets himself and presses down on the accelerator, another error is recorded against him.

IT TAKES 15 minutes for the device to complete its cycle of sudden flashes of different colored lights, each carrying a different warning signal to the man behind the wheel. When the test is finished, a completed count of errors and of "perfect" marks is shown on the automatic counters, and these records give a practically perfect picture of the subject's ability to think quickly in case of emergency, as well as indicating whether he has the necessary caution to make a safe driver.

That this test is a practical one is indicated by the preciseness with which it tallies with the actual accident records of the taxi drivers tested by it. Every man who had no accidents



## STOP! Try This Test on Yourself

*UNDER each of the following statements are three conclusions, only one of which is correct. In each case mark a cross before the answer which you think is right. If you can't pick the correct answer immediately, you are not fit to drive a car.*

1 —When on slippery pavement, you should not disengage your clutch and apply your brakes suddenly because:

Too much power is lost.

The danger of skidding is increased.

Stopping suddenly is hard on the tires.

2 —You should not pass another machine on a hill because:

It is difficult to get up speed on a hill.

You are likely to strain your car if you increase its speed on a hill.

You might run into another machine which cannot be seen approaching over the brow of the hill.

3 —Going down a steep hill, if your brakes are not good, you should:

Leave the car in gear, with motor running, and go down on compression, using the brake as necessary.

Throw out the clutch, with the motor running, and apply the brake.

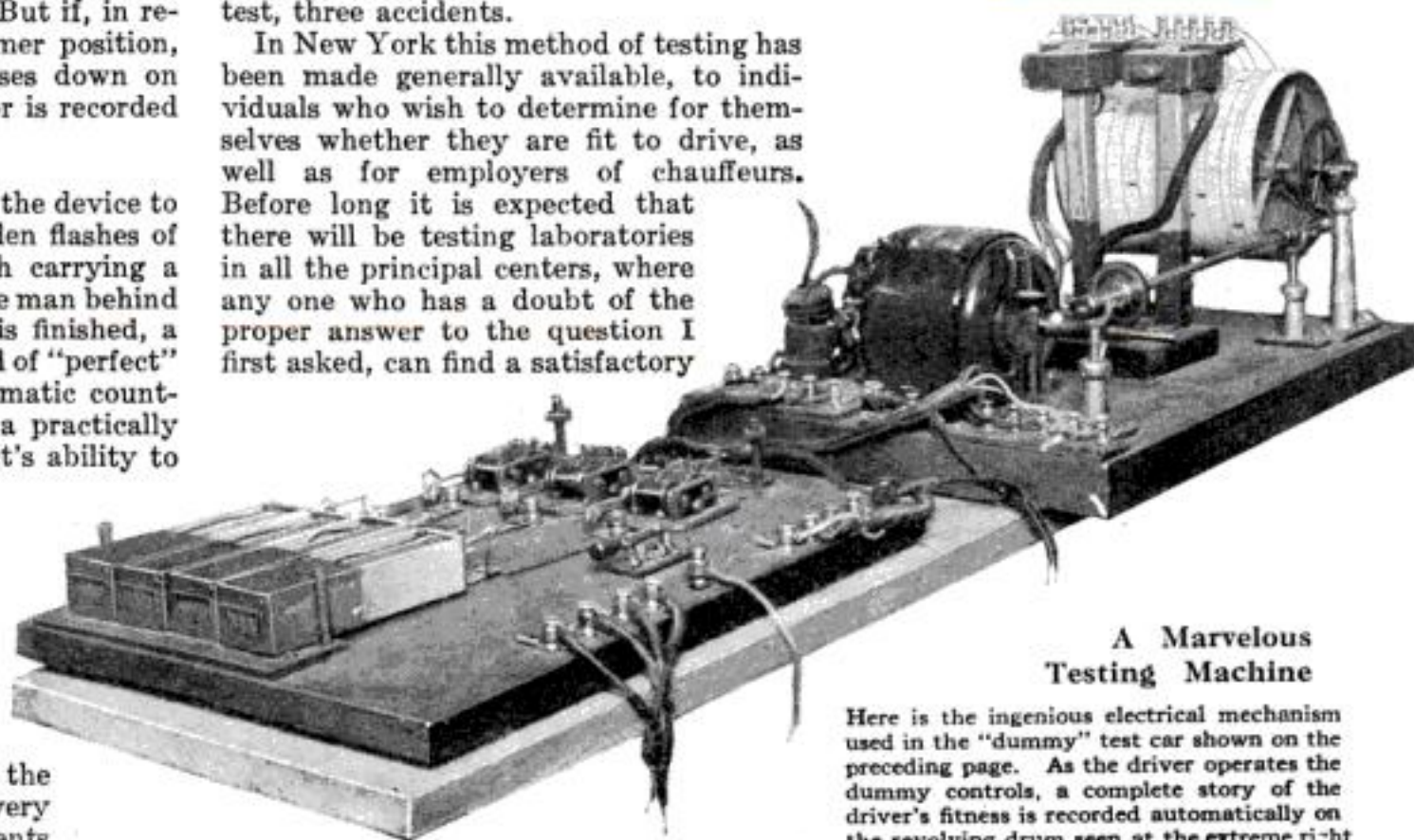
Leave the motor running with the emergency brake applied.

against him on the company's records made a perfect score in the tests; every man who had had enough accidents to rate him as a poor driver on the company's books failed seriously in the tests. The average record for those passing the tests was 1.3 accidents; for those failing in the test, three accidents.

In New York this method of testing has been made generally available, to individuals who wish to determine for themselves whether they are fit to drive, as well as for employers of chauffeurs. Before long it is expected that there will be testing laboratories in all the principal centers, where any one who has a doubt of the proper answer to the question I first asked, can find a satisfactory

mined, and this has been made the basis for a series of stop-watch tests in which the person under examination gives a demonstration, not only of his ability to handle a car, but of his "fear-time" reaction.

(Continued on page 158)



A Marvelous  
Testing Machine

Here is the ingenious electrical mechanism used in the "dummy" test car shown on the preceding page. As the driver operates the dummy controls, a complete story of the driver's fitness is recorded automatically on the revolving drum seen at the extreme right

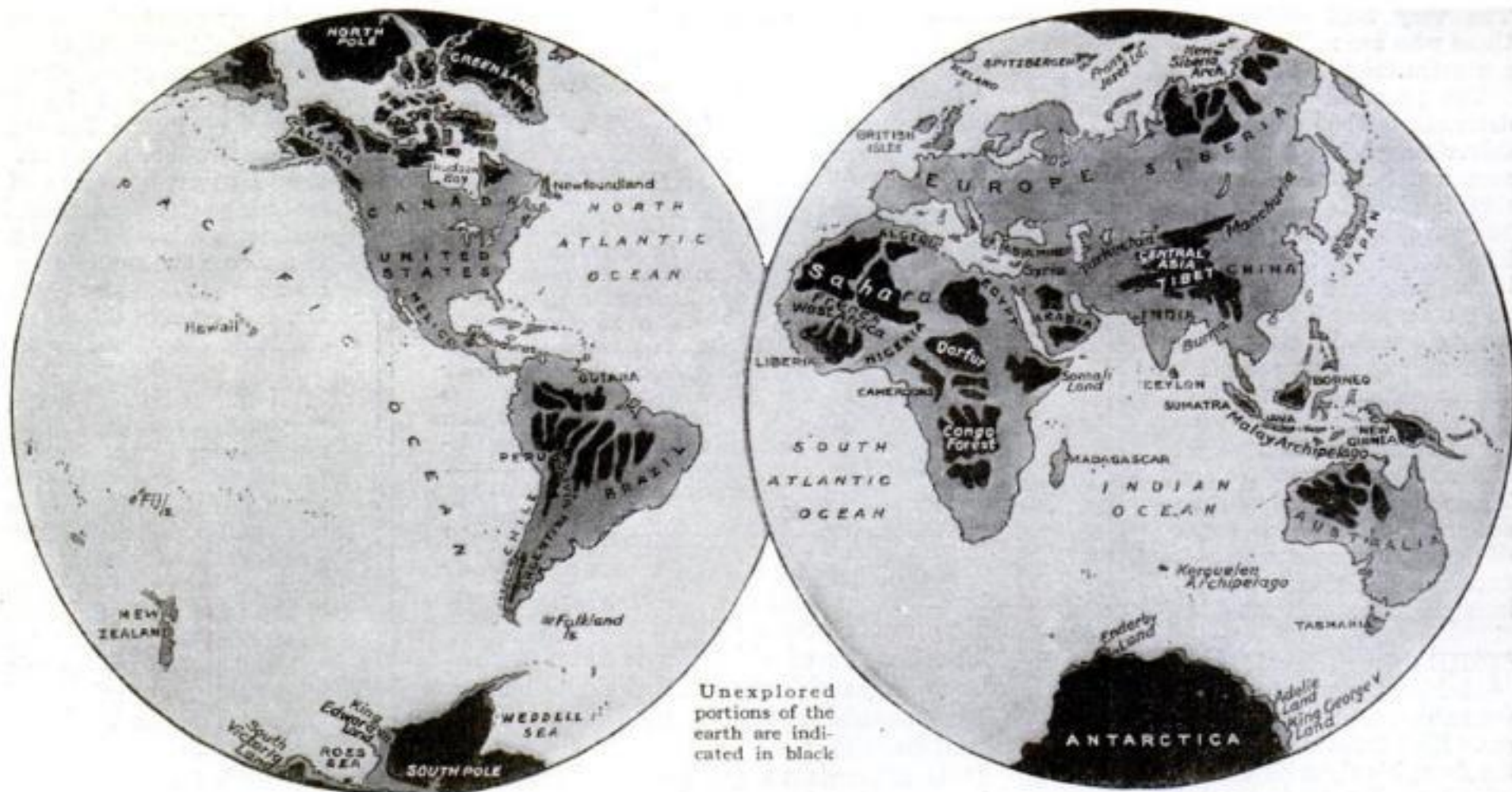
and very convincing answer.

In Washington, D. C., as a result of a set of psychological tests worked out by the Bureau of Public Personnel Administration, as a part of the Hoover program for motoring safety, every applicant for a driver's license has to undergo an examination of a somewhat different character, but equally designed to eliminate the unfit driver.

AN INGENIOUS method of determining the time required for different drivers to react to a danger signal was devised by H. H. Allen of the U. S. Bureau of Standards. Two pistols were fastened to the runningboard of the test car, both pointed downward and loaded with red-lead bullets which made a bright splotch of color on the pavement when discharged. By means of a string, the examiner, seated beside the driver, discharged one pistol unexpectedly. This was the signal to stop at once, and the application of the foot-brake automatically discharged the second pistol. The distance between the two red marks thus made on the pavement showed how far the car had traveled before the subject reacted to the danger signal, and the elapsed time also was determined by calculating the known speed of the car.

By repeating this test with several hundred drivers, an average time within which a good driver should react to an emergency was deter-





Unexplored portions of the earth are indicated in black

## Earth's Unknown Lands Beckon Explorers

**W**HEN Theodore Roosevelt, Jr., sailed for Asia, early last summer, a young fellow standing on the pier remarked:

"Well, he's off, but I'll bet he won't have as much fun as his dad did. Teddy, Senior, lived when there was still some real exploring to be done."

For this disconsolate chap and for you, too, if you feel that you were born too late for adventure, our artist has prepared the map of the world at the top of this page. Scattered over the two hemispheres are areas colored black. Each of these is a region into which white men never have penetrated, or that practically is unexplored.

The highest mountain in the world yet may remain to be discovered. A fabulous radium mine may be awaiting a prospector. The most luxuriant valley on earth may lie hidden between unknown rivers.

When Admiral Peary came back from his last trip to the Arctic, he told of several thousand square miles in the Far North where in summer there are miles of green grass, where musk-oxen, polar bears, foxes, seals, walruses, eagles, ducks, and geese have undisputed dominion. As yet they belong to

no man. And only a few weeks ago Donald B. MacMillan returned out of the North after a vain attempt to explore by airplane a vast arctic continent thought to exist just below the Pole. Among other discoveries in Greenland he found the remnants of ancient habitations of the Norsemen. Practically the whole of the polar regions is yet to be revealed and mapped.

Between Antarctica and Australia

there lies a bit of land called the Kerguelen Archipelago. On it there is room for three or four millions of intelligent human beings with prosperous farms and humming factories. Now it has a population of 50 sailors, once shipwrecked there.

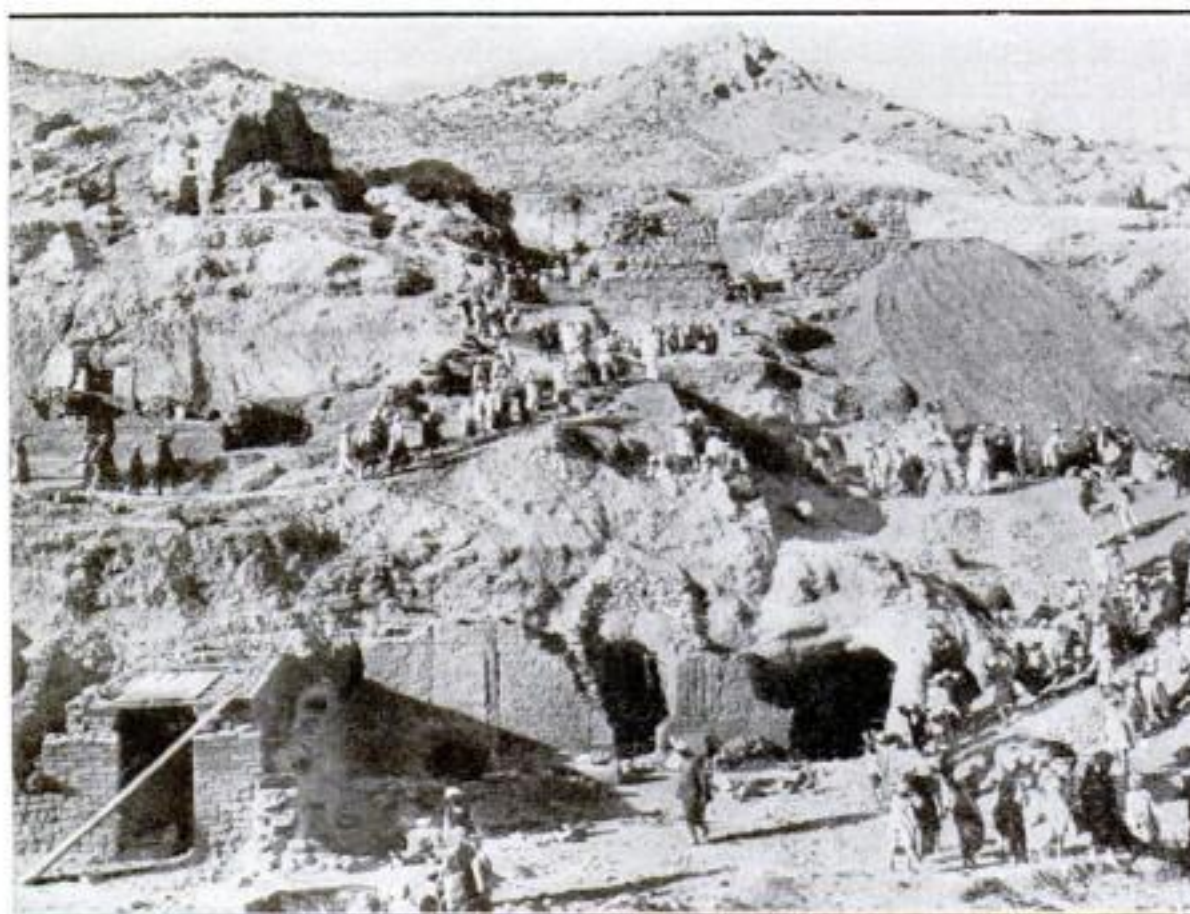
Of the lands outside of the icebound regions, Africa is the least explored. Bands of nomad, black-veiled desert robbers, alone, know the secrets of the interior of the Sahara that some one some

day is going to change with a magic wand into great plantations. Dutch and English explorers have reported mountains in the interior of Liberia and French West Africa, but very little is known about them. Their altitudes have not been determined scientifically, and the animals that live on their slopes have not been identified.

In South America, too, adventurers, following up the courses of unknown rivers, may find queer beasts, birds, and men, whose like we never have seen. As for fossil finds, the possibilities are endless.

Aerial travel and photography will make exploration of the future a much quicker process than in the past. But the thrilling part of it is that it will be in our day. Adventure is still before us.

### Unearthing Riches of Ancient Pharaohs



**T**HIS remarkable picture shows Egyptian workers under the direction of leaders of the expedition headed by a staff from the University of Pennsylvania opening the tomb of the courtiers of the Pharaohs in the ancient royal cemetery at Thebes. This site is near the tomb of Tut-ankh-Amen, opened by Howard Carter last year. Much of the material that is being excavated has been presented to the university by the Egyptian authorities



# Prize-Winners

## *in the July*

# "What's Wrong"

## Contest

*Correct Answers Tell You  
How Nearly You Were Right*



**First-Prize Winner, a Handy Woman**

Louise Gardiner Walshe, winner of the first prize of \$500, at her home workbench

faction of knowing that I have done well in a contest in competition with many other people. There is nothing more thrilling than to win a competition. You deserve a great deal of credit for originating one of the cleverest and most entertaining prize contests ever given to the public."

Commander Bates' contribution was in booklet form, with the contest pictures pasted on the pages, accompanied by witty and descriptive limericks and correct typewritten answers. It was an excellent piece of work, though lacking somewhat in the skill exhibited by the winner of the first prize.

**T**HE winner of the third prize of \$50 is John M. Lorenz, of Los Angeles, Calif. The snapshot on the next page shows him at his favorite pastime of hiking, seated at the entrance to a small cavern in the Red Rock Canyon of California. He also prepared his contribution in booklet form.

The names of the five prize-winners who are awarded \$10 each, and of the 60 winners who are awarded \$5 each appear at the top of the next page. Look and see if your name is on the list.

Each contribution was gone over carefully by the judges, who based their final decisions on three points—accuracy, clearness, and skill of presentation. The competition was so close that many contestants whose contributions showed remarkably painstaking care, failed to win a prize simply because of some slight error.

But even if you have failed to win a prize in either the June or July contests, don't be discouraged. If you entered the August or September Monthly Contest, or the Grand Prize Contest, you still have a chance to win one of the big cash awards.

Winners in the August Contest will be announced in next month's issue of POPULAR SCIENCE MONTHLY. Winners in

### The Three Best

**T**HE first three prizes in the July "What's Wrong" Contest are awarded by the judges as follows:

#### FIRST PRIZE, \$500

Louise Gardiner Walshe,  
Jersey City, N. J.

#### SECOND PRIZE, \$100

Lieut.-Comm. Paul Marshall Bates,  
U. S. N.,  
McCook Field, Dayton, Ohio

#### THIRD PRIZE, \$50

John M. Lorenz, Los Angeles, Calif.

*Names of winners of the other 65 prizes will be found on next page.*

Miss Walshe's contribution was submitted in the form of the second act of a four-act play which she entitled "A Comedy of Errors," each act representing one of the four monthly contests, all of which she entered. Attractive pen-and-ink lettering adorned the cover and title page. Each page of the volume represented a scene in the "comedy." On it was pasted one of the eight contest pictures, and below the picture, in neat typewriting, were the correct answers. Decorating the bottom of the pages were excellent pen-and-ink drawings correcting the artist's mistakes.

**T**HE second prize of \$100 goes to a navy flier—Lieut.-Comm. Paul Marshall Bates, U. S. N., stationed at McCook Field, Dayton, Ohio. When we wrote to Commander Bates the other day, asking him for his photograph, he guessed there might be "something in the wind"; for, in sending his picture, he replied:

"When I opened your letter requesting my photograph, it gave me the thrill that comes once in a lifetime. It isn't the possibility of winning money, but it's the satis-



**Second-Prize Winner, a Flier**

Lieut.-Comm. Paul Marshall Bates, U.S.N., winner of \$100 second prize, in his flying togs at McCook Field



# Additional Prize-Winners in the July Contest

## FIVE PRIZES—\$10 EACH

W. S. Bowman, Orangeville, Pa.  
L. B. Hendershot, West Hartford, Conn.

Charles S. Nichols, Ames, Ia.

Randall M. Hendricks, New Haven, Conn.  
F. W. Horton, Hackensack, N. J.

## SIXTY PRIZES—\$5 EACH

F. W. Schmid, Dubuque, Ia.  
Paul O. Katz, Detroit, Mich.  
Arthur Higgins, Platteville, Wis.  
Ril. C. Keefauver, Coffeyville, Kan.  
Guy Campbell, New York City  
I. H. English, Lakeland, Fla.  
Harry R. Fisher, Claymont, Del.  
R. C. Bentley, Williamsburg, Va.  
R. E. Ammermann, Laurium, Mich.  
D. J. Hansen, Chicago, Ill.  
H. M. Rose, Huntingdon, Pa.  
T. P. Fliegenschmidt, Indianapolis, Ind.  
Walter I. Scott, Minneapolis, Minn.  
A. R. Stimson, Rockmart, Ga.  
Clyde F. Swigert, St. Joseph, Mich.  
Richard C. Tarr, Gloucester, Mass.  
E. J. Uht, Dayton, Ohio  
Mrs. Philip Becker, Jr., Peoria, Ill.  
E. L. Nichols, Fairmont, W. Va.  
Mr. and Mrs. J. W. Plummer, Olympia, Wash.  
John C. Elder, Somerville, N. J.  
L. S. Haskin, Glenham, N. Y.

C. O. Greenleaf, Sarnia, Ontario, Can.  
Milton A. Graves, Evanston, Ill.  
Richard A. Glass, Little Rock, Ark.  
Roger Hackney, Birmingham, Ala.  
G. T. Fowler, Bakersfield, Calif.  
Charles W. Belt, Newark, Ohio  
H. N. Aldrich, Rosalie, Neb.  
W. Davidson Harbaugh, Piqua, Ohio  
William J. Irwin, Philadelphia, Pa.  
Ruth H. Kienle, Schenectady, N. Y.  
Carrie W. Merryman, West Philadelphia, Pa.  
Leon D. Munger, Southington, Conn.  
Robert W. Mullen, West Point, N. Y.  
Thorwald Pedersen, U. S. Marine Hospital, San Francisco, Calif.  
Harry Reynolds, Oakland, Calif.  
John Harold Remick, East Braintree, Mass.  
C. W. Sinniger, Roseburg, Ore.  
S. V. Trent, Jr., Salt Lake City, Utah  
Lester E. Tookey, Denver, Colo.

David C. West, Lake George, N. Y.  
Elizabeth Russell, Brooklyn, N. Y.  
B. O. Burgin, Albany, N. Y.  
Joseph H. Glasser, Cleveland, Ohio  
Charles Haustein, St. Louis, Mo.  
J. B. Hobson, Fort Smith, Ark.  
Sergt. W. R. Kuhn, C. A. C., Fort Monroe, Va.  
L. W. Waugh, Roslindale, Mass.  
George Jos. Mess, Indianapolis, Ind.  
Helen Howard, San Diego, Calif.  
Miss Rutherford D. Holdredge, Los Angeles, Calif.  
William Leyh, Richmond Hill, N. Y.  
Lt. Lester F. Rhodes, Schofield Barracks, Honolulu, T. H.  
A. G. Law, Englewood, N. J.  
A. E. Livingston, Wayne, Pa.  
A. J. Snow, Salt Lake City, Utah  
John A. Whamer, Schenectady, N. Y.  
Edwin T. Brown, Pittsburgh, Pa.  
Albert L. Snedaker, Mt. Ephraim, N. J.

the September contest will be announced in the February issue, and the Grand Prize Contest winners as soon as possible thereafter.

So that you may compare the answers you submitted and see whether they were right or wrong, the complete list of correct answers to the 16 pictures in the June and July contests are printed below. For each picture you were asked to tell, first, what John or Mary or both were doing wrong, and why it was wrong; second, what deliberate mistake the artist had made in drawing the picture.

In the following list of correct answers A in each case is John's error; B is the artist's mistake:

### JUNE CONTEST ANSWERS

Picture No. 1. A—John is painting himself into a corner. He will have to walk over fresh paint to get out of the room. B—The artist has shown the can of paint unopened. The top should be off.

Picture No. 2. A—John is hanging the shade without rolling it up. The best practice is to roll the shade completely before hanging to tighten the spring. B—The reflection in the mirror, as shown by the artist, is an impossibility, for the mirror would have to be on the opposite side of John to show such a reflection.

Picture No. 3. A—John should have painted the ceiling before painting the walls, for he is sure to get paint on the wall-paper. B—The artist shows the window-shade hanging outside the window, instead of inside.

Picture No. 4. A—John is overlapping the shingles the wrong way. He should start shingling from the eaves and work up toward the peak of the roof. The bottom edge of each shingle, instead of the top edge, should be exposed. The roof will leak like a sieve if shingled the way he is doing it. B—The artist has drawn buttons on the wrong side of

John's vest. Buttonholes should appear where the buttons are.

Picture No. 5. A—The hole should be bored so that the opening outside the house will be lower than the inside opening. As John is doing it, the rain will run through. B—The hook and receiver of the telephone on the table are drawn on the wrong side of the instrument.

Picture No. 6. A—John has jacked up his car and is changing a tire on a hill without blocking the wheels. The car will roll downhill. B—The front wheel of the car has 12 spokes, while the rear wheel

has nine. A Ford car should have 12 spokes on each wheel.

Picture No. 7. A—John is trying to build a fire in the furnace with the damper shut. This will fill the cellar with smoke and prevent a draft up the chimney. B—The artist shows the rosette fastened to a beam inside the coalbin, with the electric light hanging in the furnace room, and yet the cord is straight. The light should hang in the coalbin.

Picture No. 8. A—John has connected the batteries incorrectly. He has connected positive poles with positive, and negative with negative. They should be connected in series. B—The artist has drawn the pliers so that the jaws will open instead of shut when the handles are pressed together.

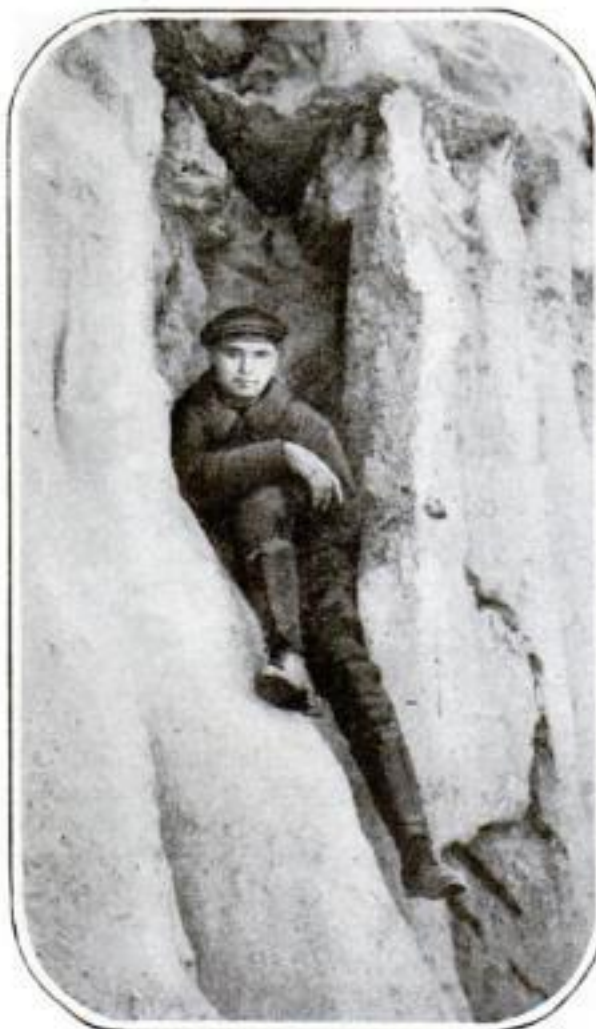
### JULY CONTEST ANSWERS

Picture No. 1. A—John is painting while the wood is still wet from rain. Painting should be done on a dry surface only. B—The clapboards on the house are overlapping the wrong way.

Picture No. 2. A—John has fastened the antenna lead-in wire to the antenna support wire instead of to the antenna. B—The hour hand of John's wrist watch points between six and seven, while the minute hand points to 12. When the minute hand points to 12, the hour hand should point directly either to six or seven.

Picture No. 3. A—John is cutting down the tree so that in falling it will strike the house. He should have used block and tackle to pull the tree the other way. B—Two different kinds of leaves are growing on the same bush in the foreground.

Picture No. 4. A—John is pouring gasoline into the gas tank of his car while the motor is running. He should have stopped the motor to eliminate danger of



**Third-Prize Winner, a Hiker**

John M. Lorenz, Los Angeles, winner of \$50 third prize, on a hike at Red Rock Canyon

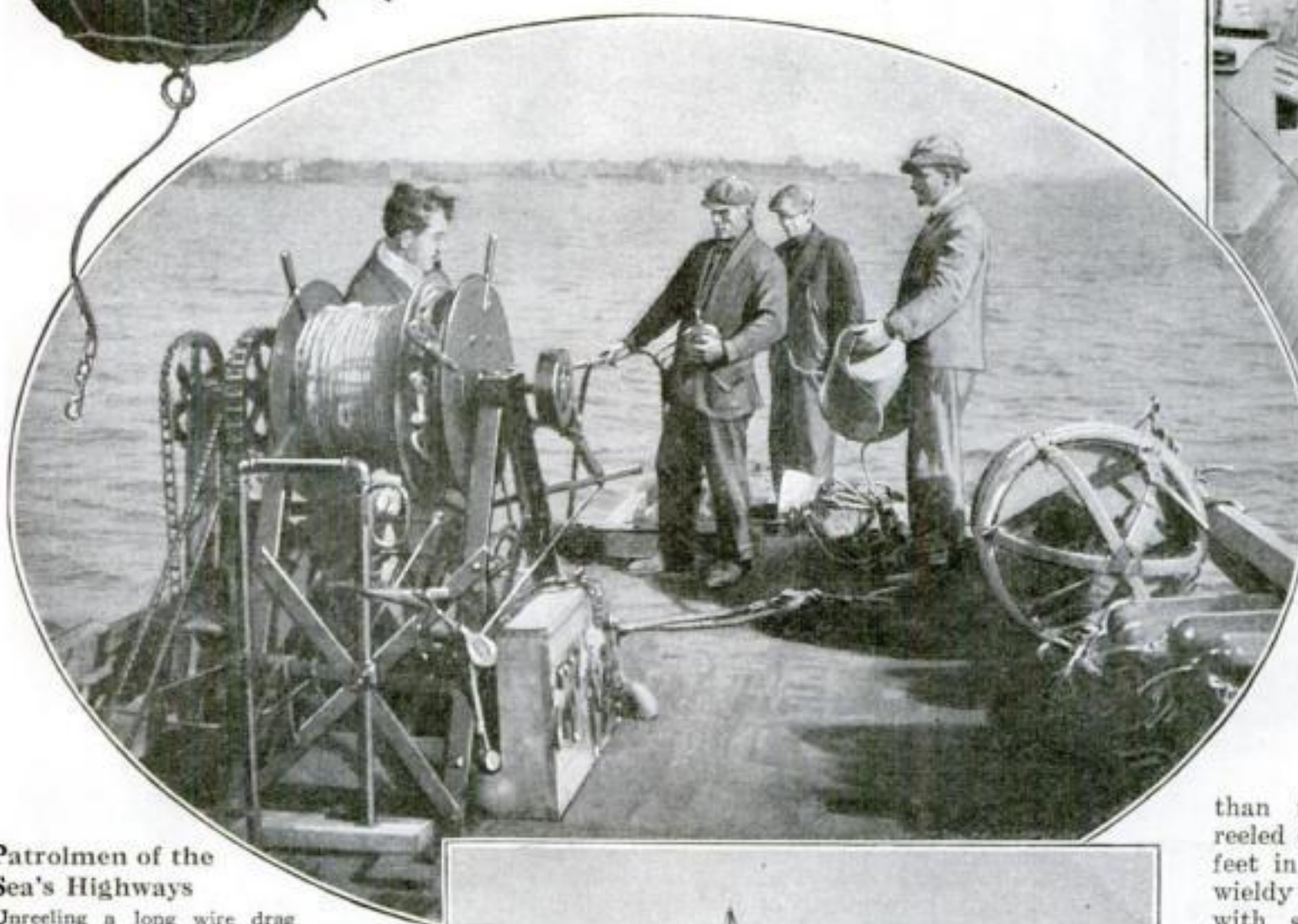
(Continued on page 165)



# Sweeping the Ocean Highways

*How Uncle Sam Guards Ships  
from Treacherous Rocks*

By S. R. Winters



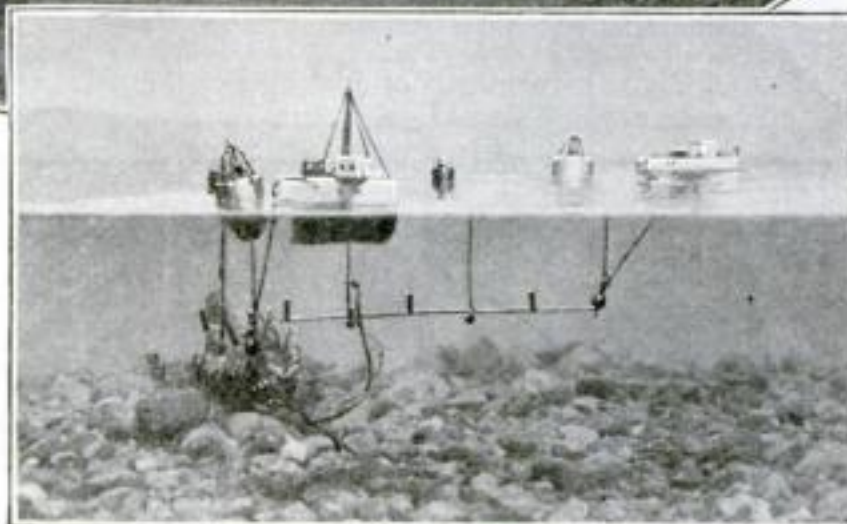
## Patrolmen of the Sea's Highways

Unreeling a long wire drag from the deck of a Coast and Geodetic Survey boat to sweep the waters for treacherous rocks and shoals. Above: A newly devised collapsible wire drag buoy used in the Survey's sweeping operations

**I**N A channel commonly traveled by shipping in Alaska waters there was discovered not long ago, the sharp nose of a huge rock hidden just beneath the water's surface. Month after month and year after year unsuspecting vessels had followed that path; yet by some miracle, fate always had steered them clear of the lurking peril that might have sent them down with fearful loss of life and cargo.

Along the ocean shipping lanes there are scores of grim reminders of ships that have gone to destruction on unseen rocks, sandbars, and uncharted obstructions. And while dragging the waters of the world for these dangers is somewhat like hunting for a needle in a haystack, the safety of present-day commerce is demanding that ocean highways be marked with danger signs as are our land highways.

It is with this idea in mind that the U. S. Coast and Geodetic Survey recently has undertaken the tremendous task of sweeping the seas. From Eastport, Me., to Long Island, N. Y., and along stretches



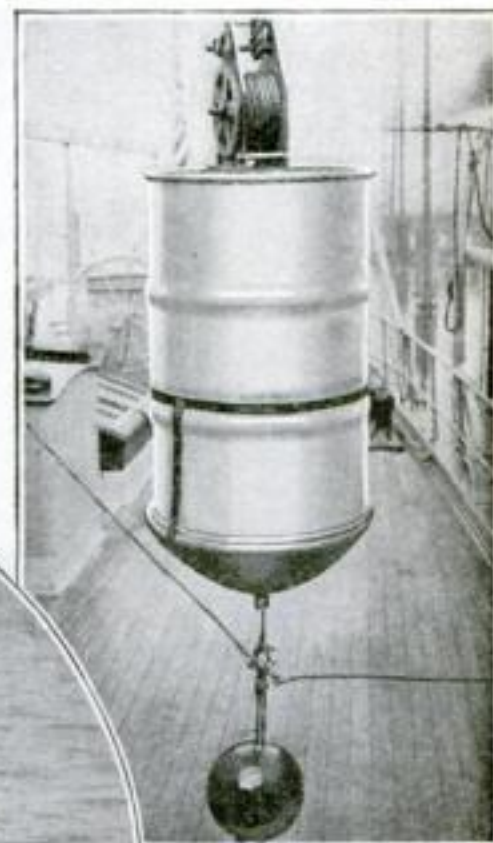
## How the Shipping Lanes Are Made Safe

A small model of the wire drag apparatus used by Uncle Sam to locate dangers to shipping. The wire sweep, lowered to a given depth, is hauled along by two power boats, looking for perilous shoal spots

of the southern, western, and Alaskan coasts, Uncle Sam is casting a dragnet for huge rocks and treacherous shoals that lurk beneath the surface. By the use of various kinds of drags, vast expanses of water now are being combed.

When a sea-dragging expedition sets out, there are two high-powered motor-boats, as a rule, each carrying one end of a wire drag or sweep. One of the ships is large enough to carry all the equipment of dragnets, wires, and buoys to mark dangerous spots.

Although a wire drag 15,000 feet long has an average speed of only  $1\frac{1}{2}$  miles an hour, as many as 15 shoal spots have been found by this means in one day. A sweep drag, with less buoys and uprights



## Gasoline Drum as Drag Buoy

The sweep wire, attached to the bottom of the weighted drum, may be lowered to any desired depth by means of the reel at the top. The suspended weight carries the buoy the desired depth

than the wire drag, can be reeled out at the rate of 10,000 feet in nine minutes. This unwieldy "broom" can be operated with surprising speed, sometimes covering as much as 60 square miles in a day.

In the design and construction of the dragging apparatus, considerable ingenuity has been brought into play. One ingenious device that has proved very effective is a buoy made from a gasoline drum and used to hold the drag wire in position at any given depth. The drum is fitted with a heavy rounded bottom to which is attached the drag wire and from which a weight is hung. By means of a reel above the top of the drum, the buoy is lowered to the desired depth.

Whenever the sweeping wire strikes a jagged rock pinnacle or a sandy shoal, the Survey ships immediately chart the exact location of the obstacle and mark it with a danger signal.

It is not without justice that this branch of the Coast and Geodetic Survey has been called the "police of the sea," for it is making the sea lanes safe for mariners.

Geologists tell us that the origin of these undersea rock formations goes back to the Glacial Age. Slowly, as climate became more temperate, masses of ice slid into the sea, carrying with them the rocks that are the source of so much danger to those who go down to the sea in ships.



# Training New "Eyes" for the Army



Standing beside a new aerial camera

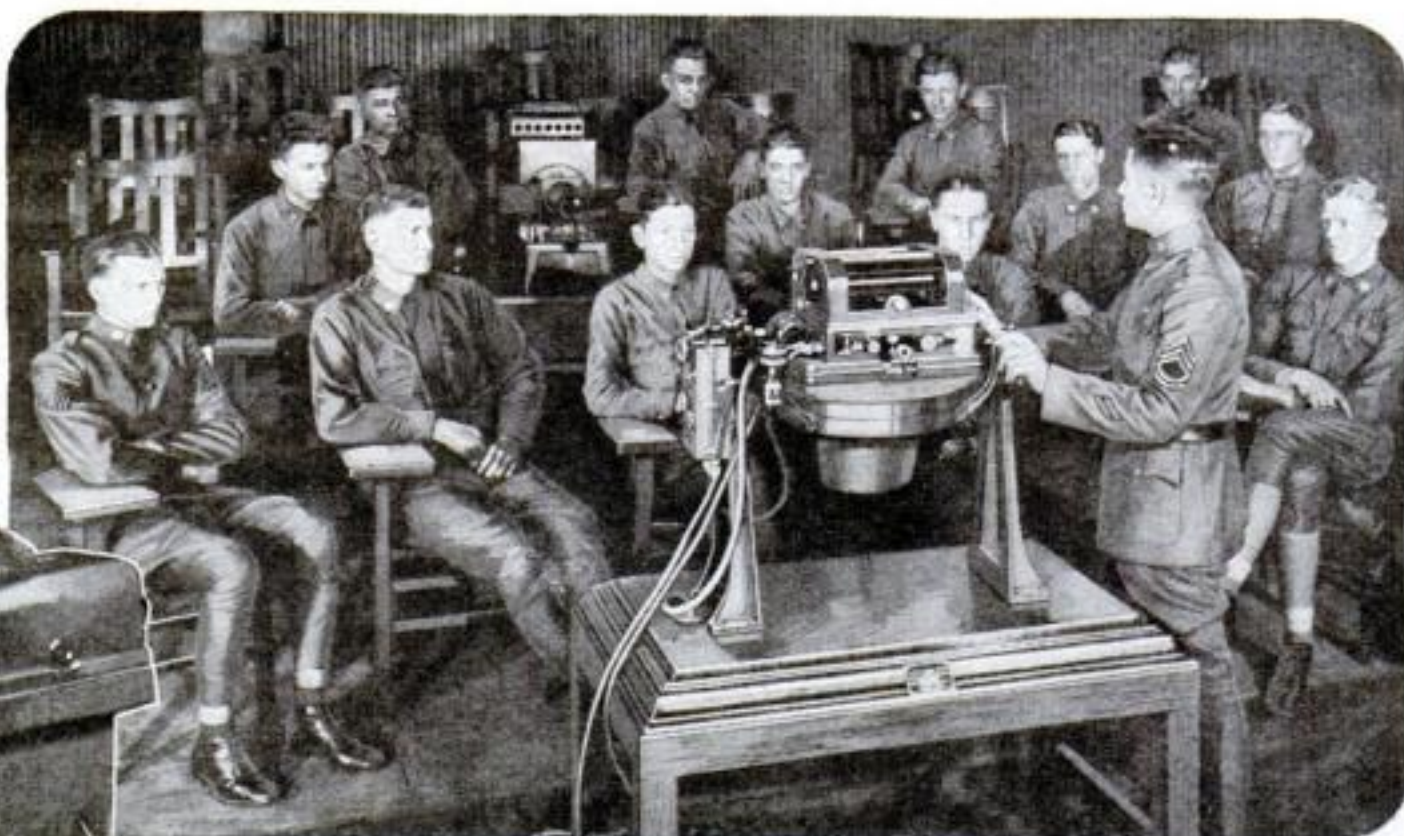
By Truman Stevens

**D**URING army maneuvers in the South a short time ago, the artillery was firing at an unseen objective or target six miles away, beyond a hill. To observe the effects of the firing, an army-trained aerial photographer from McCook Field, Dayton, Ohio, went up in his plane and soared above the field of operations.

Discovering that the shells were falling wide of the mark, he quickly took a photograph of the target, showing just how the shells were bursting. Then, while the plane flew back to the firing line, he developed his print. Arriving above the line, he placed the print in a message pouch and dropped it from the plane. The artillery commander, after a moment's study of the photograph, ordered corrections made in the sighting of the guns, and the next round of shells struck the target squarely.

The entire process of making and developing the photograph had taken just six minutes!

A week or so later other McCook Field pilot-photographers completed remarkable experiments in surveying farm lands from an altitude of 5000 feet, taking 60 photographs with a powerful aerial camera recently developed. So successful were



A class in the Air Service School of Photography, Chanute Field, Ill. An expert is explaining the operation of an improved aerial camera. Left: Dr. S. M. Burke, U. S. Air Service photographic expert, in his flying togs, standing beside a new aerial camera

## Flying Photographers Make Pictures in Six Minutes

the tests that government officials expressed the belief that airplanes can be used to practical advantage every summer to supplement the regular crop census, made once in five years.

These incidents offer just two striking examples of how Uncle Sam in recent months has been developing more and better "eyes" for the army for practical purposes of peace as well as of war.

And the thing that is largely responsible for this development is the comparatively recent establishment of an Air Service School of Photography at Chanute Field, Rantoul, Ill., the only school of its kind in America, and probably the only one in the world.

Here raw recruits are trained by experts in all branches of photography, but par-

### A Huge Film

A huge film roll used in the latest type of aerial camera, as compared with a roll from an ordinary pocket camera. The film can be developed during the flight

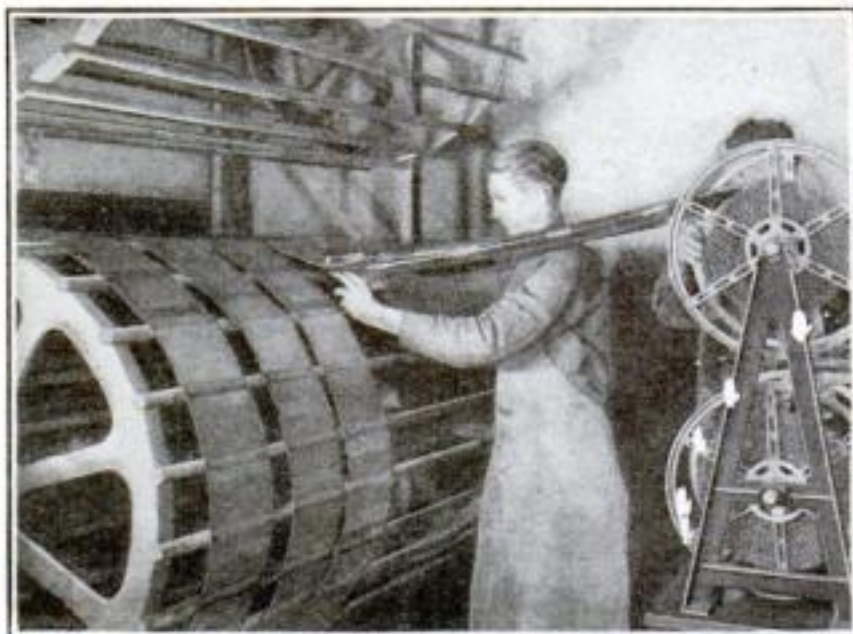


ticularly in the new profession of aerial photography. The students obtain their experience both on the ground and in the air. Beginning with the rudiments of photography, they eventually acquire a mastery of the construction and operation of the most improved cameras, lenses, developing and printing machines, and other apparatus. A large proportion of the students' work is confined to the actual "shooting" of pictures from the air.

The recruiting of new men for this technical school of the Air Service recently was authorized by the War Department.

As the result of newly invented cameras, camera accessories, laboratory apparatus and materials and the training of experts in their use, officers at Chanute Field declared that "the quality of aerial photographs now being made is far superior to that possible during the war."

"By reason of the perfection of aerial film," they added, "it is possible now to take successful photographs from the air that would not have been attempted during the great conflict."



### Where Recruit Flyers Learn Photography

Drying aerial photographic film in the laboratory of the Air Service School. Every process of photography is mastered in the course



# What Sport Can You Excel In?

*Newest Tests Tell whether Your Best Game Is Golf, Tennis, Track, or Boxing—What Makes a Champion*

By Peter Vischer



**Walter Hagen**

Like the other champion athletes pictured on these pages, this famous golfer is of the ideal athletic type—tall and rangy, with square shoulders, big chest, slim waist, and strong, sturdy legs



**Harold Osborne**

The world's champion high jumper has cleared the bar at 6 feet 8 1/4 inches. He, too, has the ideal rangy build. Note the "grass-hopper" legs—long in the thighs—characteristic of great jumpers



**Walter Johnson**

Another ideal athlete. His towering frame, broad shoulders, and powerful muscles have given him the dazzling speed that has made him one of the greatest baseball pitchers ever seen on a diamond



**William T. Tilden II**

The perfect build for a tennis champion. Although rangy like Hagen, he is slimmer, for his game requires great speed of action

**I**F YOU are of sound body, can you take part in athletics to your advantage? Can you excel? What's the best sport for you?

A million young Americans just going into long pants, or for that matter as many older Americans just going back into short pants, ask themselves these questions every year. They see about them strapping young athletes; erect, lithe-limbed, clear-eyed, strong, bronzed with health, happy. They see among them the world's champions in almost every line of sport.

It is instinctive that onlookers should want to try some form of athletics for themselves, try to emulate those they watch. Can they?

Most assuredly, says science; athletic competition is for every one. Moreover, science now, by taking stock of your physical conformation and subjecting you to certain tests, can predict for you in advance what sport, or sports, you are most likely to excel in.

It was only a few weeks ago that Prof. A. V. Hill, of London University, disclosed to the physiological section of the British Association for the Advancement of Science in his presidential address the amazing discoveries that science has made in the field of sport.

For example, Professor Hill showed to his fellow scientists a series of charts he had devised after many years of experiment. Taking account of a man's physical measurements—his weight, his height, his lung capacity, and so on—and subjecting him to certain tests, Professor Hill claimed by means of these charts to be able to pick that man's best sport for him. He could readily differentiate, he said, between a likely sprinter and a possible long-distance runner; between a future tennis champion and a good golf prospect. Further, he stated in effect, most of those he had tested never had engaged seriously in athletic sports, although some possessed a physical endowment that made success for them in some sport altogether likely. In other words, in the opinion of this scientist, there is some sport at which each of us can excel if we will find it.

True, not all of us can be champions. That is obvious. Some few have to excel. Baseball always will have its Cobbs

and Ruths; its Dazzy Vances and Walter Johnsons. In tennis a Tilden comes only in a generation. Such golfers as Bobby Jones and Walter Hagen, such sprinters as Charlie Paddock, such swimmers as Johnny Weissmuller, are exceptions, lifted above their fellow men by some amazing co-ordination of brain and muscle. So it is with boxing champions such as Dempsey and Benny Leonard, football players such as Jim Thorpe, the Indian, whom many athletic critics regard as the most remarkable athlete in point of versatility who ever lived. So it is with marvels of the spectacular game of polo, such as Devereux Milburn and Tommy Hitchcock.

And yet each of these had to start in comparative mediocrity. No man ever went to sleep a dub and woke up a champion.

**T**HEY all started more or less on a par. As kids they were something like their neighbors—like you and the rest of us. Perhaps they had slight advantages of physique. At any rate, they worked to develop themselves until today Paddock has steel springs where most men have only legs; Tilden has catlike speed that is rhythmic perfection; Vance has a right



arm excelled by none; Dempsey has supple, rippling muscles in his back; Weissmuller has a chest to house the lungs of a giant. Each one of these athletes, starting more or less like all the rest, has developed that particular part of his physique most valuable and most needed for his chosen sport.

**C**URIOSLY, though, these men still are somewhat alike. There is an ideal athletic type, and all these champions are akin to it, deviating only where a difference has accrued as a result of their specialization. Tilden, for example, is slimmer than Hagen, because Tilden needs greater agility, greater speed of movement, faster footwork on a tennis-court than does Hagen on a golf course. Hagen needs stability, intencess, strength. Tilden hits a fast-moving ball and Hagen one that is stationary. It is natural that the one should have less to carry with him than the other.

Almost all of these champions range in height from 5 feet 10 inches to a little over 6 feet. They have square shoulders, big chests through the body, slim waists; sturdy torsos set on legs that are rather long from knee to hip, and, above all, strong. Such is the scientific average of the typical athlete.

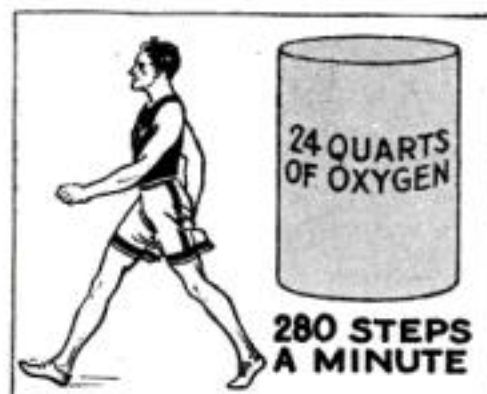
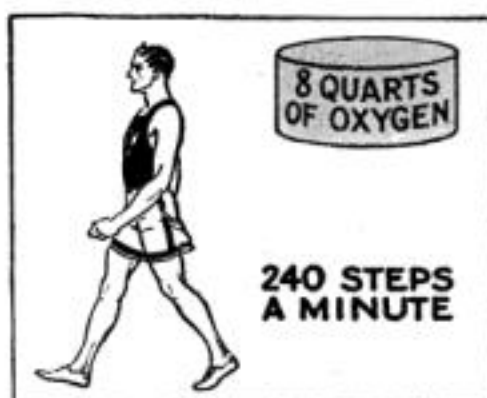
Because I wanted to know whether the opinion of the practical trainer of athletes coincided in these respects with that of the scientists, I went to Charles E. Barrett. Barrett was for 25 years trainer of all Williams College teams and has been for the last five years trainer of all teams at Columbia University. He has been for years a scout for Connie Mack, manager of the Philadelphia Athletics. I'll wager that the line of athletes of all kinds who have passed in review before the cold, scrutinizing gaze of the tousle-haired grayhead known as "Doc" Barrett would reach three times to the moon and back.

"**MY BOY,**" he said, "athletic champions have to be bred. They're like horses. You can't take any boy in the world and make a real champion out of him. He has to get something from his father and he has to get something from his mother. I know, because I've trained lots of boys and I've seen them grow up and go away and I've seen their sons come back to me.

"He has to get more than a body, too. If he's going to be a real athlete, of any kind, he has to be what I call rangy. He ought to be fairly tall, from 5 feet 10 to 6 feet 1. He ought to have a solid frame with strength in his shoulders, weight through his chest and not in his seat. He must have lungs, a strong abdomen, strong thighs, and good hands and feet.

"But he must have more. He must have something here"—(Doc Barrett tapped his forehead)—"and he must have something here"—(he tapped his heart). "And neither of them can be a chestnut."

So, take it from Doc Barrett, not every man can be a champion. Which is as it should be. A champion should be exceptional. He should have more than a



#### The Athlete's Fuel

Scientific tests have shown that if a walker increases his pace from 240 steps a minute to 280, he must use up triple the amount of oxygen



#### Jack Dempsey

Not only is the world heavyweight champion rangy and powerful, but he is lightning fast on his feet. The muscles in his back are exceedingly supple

#### Jim Thorpe

The famous Indian football star, big league ball-player and Olympic all-around champion, is perfectly built for any sport

chestnut in his head and in his heart. It's altogether fitting and proper, I think, that generations should do their part in bringing forth champions.

On the other hand, if you are so fortunate as to be born with the advantages Barrett describes, you can become a champion by practice, practice, determined and incessant practice. And more practice.

"I am convinced after 30 years' study of athletes," Barrett went on, "that athletics is 95 per cent mechanical. I repeat, 95 per cent mechanical, because I can see you think I'm much too high and fear I may have misspoken myself.

"Your great baseball star, your football back who has been burning up the opposition, your husky crew man, your slippery basketball forward, your tennis champion, your golf shark—it's the same with all of them. They have to keep at it until their work is 95 per cent mechanical.

"Now don't think for a second that because I say athletics is 95 per cent mechan-

ical, I think an athlete doesn't need a head. Of course he has to have a head. He has to be so trained, so keyed up, so perfect mechanically, that he's always on the jump, ready to steal the other fellow's stuff. I've been at this for a while of a long time and I don't ever think I knew it all. I'm always watching the other fellow, ready to steal his stuff if he's got anything better than I have."

**S**O, IF you're blest with the born athlete's physique, and have a head on your shoulders, you can make an athlete of a sort. If you are agile and quick, fast on your feet, strong in your arms and shoulders, and are possessed of a sense of anticipation, in addition to being rangy, you can make a tennis player. In this game you need not only powerful strokes, but unusual speed and the ability to concentrate. You need patience, too, for it takes at least three years to learn an effective tennis stroke. William T. Tilden II, the present champion and undoubtedly the greatest tennis player the world has ever seen, has the perfect build for a court champion. And yet, it would be dangerous to generalize and say that only men of Tilden's build can be champions. Little Bill Johnston, for years his closest rival, is too short and slight for the ideal build.

In other words, there are exceptions in all sports. Doc Barrett would seek as track men those with supple muscles and long thighs, with strong ankles and light waists. No track man can carry extra poundage around his hips. In a way that description would let out Charlie Paddock, the fastest human who ever did a dash, and Arthur Duffy, the first man to run 100 yards in 9 3/5 seconds. These two were a bit too chunky for ideal track athletes, but Barrett considers them true exceptions, athletic freaks, and if you argue with him he'll point out that such runners come but once in a generation.

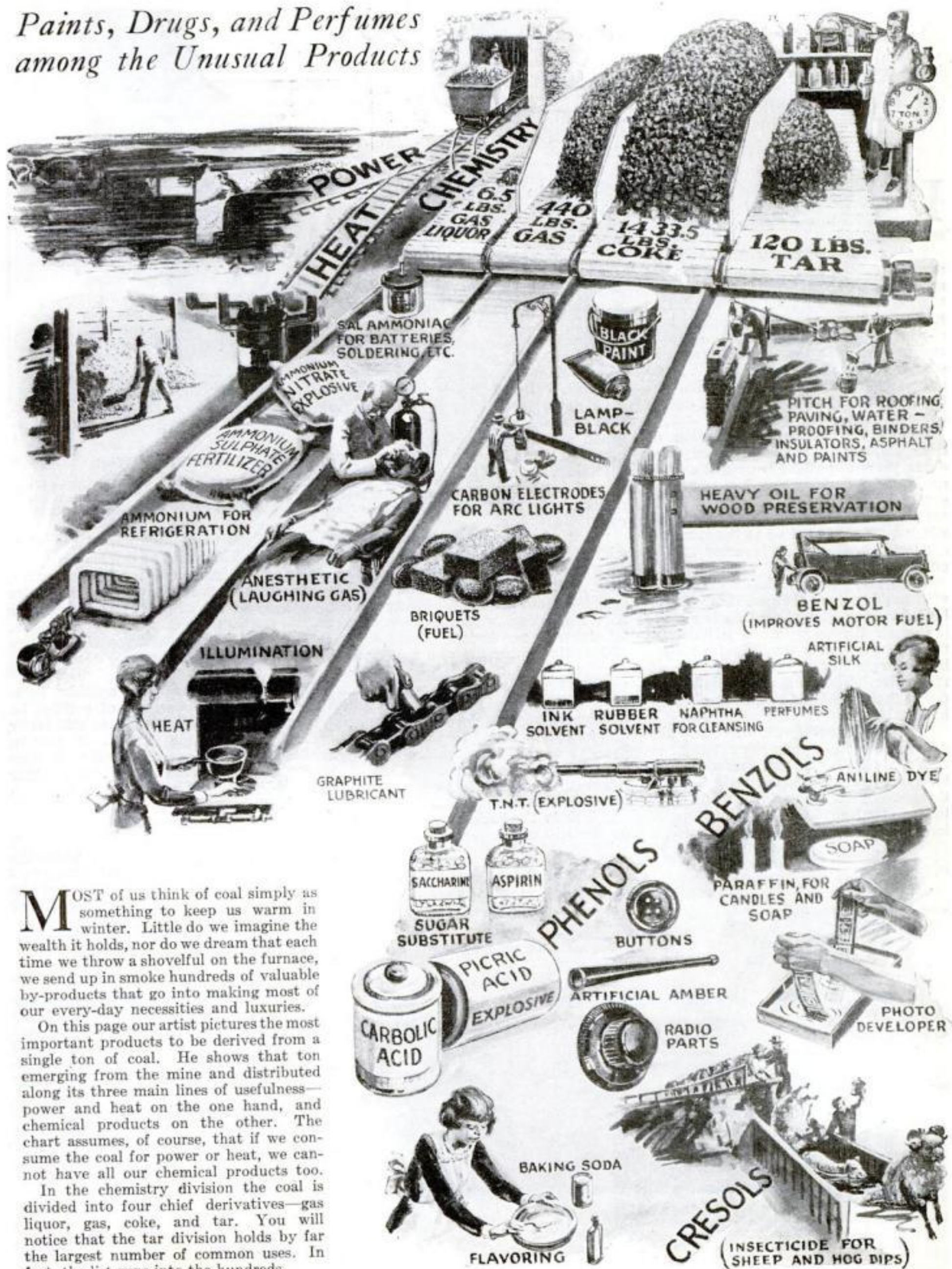
**T**ED MEREDITH, holder of the world's half-mile record, the great runner Lawson Robertson developed at Penn, was an ideal track man. He is broad-shouldered, slim-waisted, big enough to fight competition, strong and heavy enough to stand the gaff; he has marvelous legs, with muscles in them like springs. No wonder he did the 880-yard dash in one minute fifty-two seconds! Bevil G. D. Rudd, the crack British runner from South Africa, who could run the 100-, 220-, 440-, and 880-yard dashes all in one afternoon, was such an athlete. Alan Helffrich, fastest of the present-day half-milers, who beat Paavo Nurmi in the latter's last American race, is of similar build. Another example was Mel Sheppard, middle-distance champion of 15 years or so ago; big, strong, yet lithe and supple, fast as lightning, a true athlete.

(Continued on page 160)



# What We Get *from a* Ton of Coal

*Paints, Drugs, and Perfumes  
among the Unusual Products*



**M**OST of us think of coal simply as something to keep us warm in winter. Little do we imagine the wealth it holds, nor do we dream that each time we throw a shovelful on the furnace, we send up in smoke hundreds of valuable by-products that go into making most of our every-day necessities and luxuries.

On this page our artist pictures the most important products to be derived from a single ton of coal. He shows that ton emerging from the mine and distributed along its three main lines of usefulness—power and heat on the one hand, and chemical products on the other. The chart assumes, of course, that if we consume the coal for power or heat, we cannot have all our chemical products too.

In the chemistry division the coal is divided into four chief derivatives—gas liquor, gas, coke, and tar. You will notice that the tar division holds by far the largest number of common uses. In fact, the list runs into the hundreds.



# Fifty Miles an Hour on a Motor-Skate

*Young Night Watchman Invents  
a Thrilling New Winter Sport*

By Edwin Ketchum

**I**N A little Swiss mountain village, some 25 years ago, there lived a boy named Thomas Avoskan, a skater of marvelous skill.

Today, having journeyed to America, that same boy, now grown, still amazes spectators as he cuts whirling figures on the ice in New York City's parks. But more than that, out of his passionate love of winter sports, he has developed an odd and unusual invention—a motorized ice-scooter that will skim over the ice at 50 miles an hour. This is the invention pictured at the top of this page and on the cover of this issue.

Behind this strange combination of skate, ski, and power wheel is a story of a dozen years of patient labor and experiment. The cycle, which has met with successful tests at Lake Placid, N. Y., is the successor to a score of others, none of which quite measured up to the standard set for himself by the inventor at the outset.

"You see," he explained, "I started with nothing more than an idea. I had been watching a long line of skaters playing crack the whip, when suddenly I thought what fun it would be for such a line to be pulled over the ice by some sort of a motor. There was a human need—a device that would add to the happiness of human beings.

"But how to satisfy that need was the question that to answer has taken all of my spare time for a dozen years. Bit by bit my present cycle evolved. First I thought of fitting the wheels with spikes to dig in the ice. Then I developed a seat for the rider. Next came the skatelike

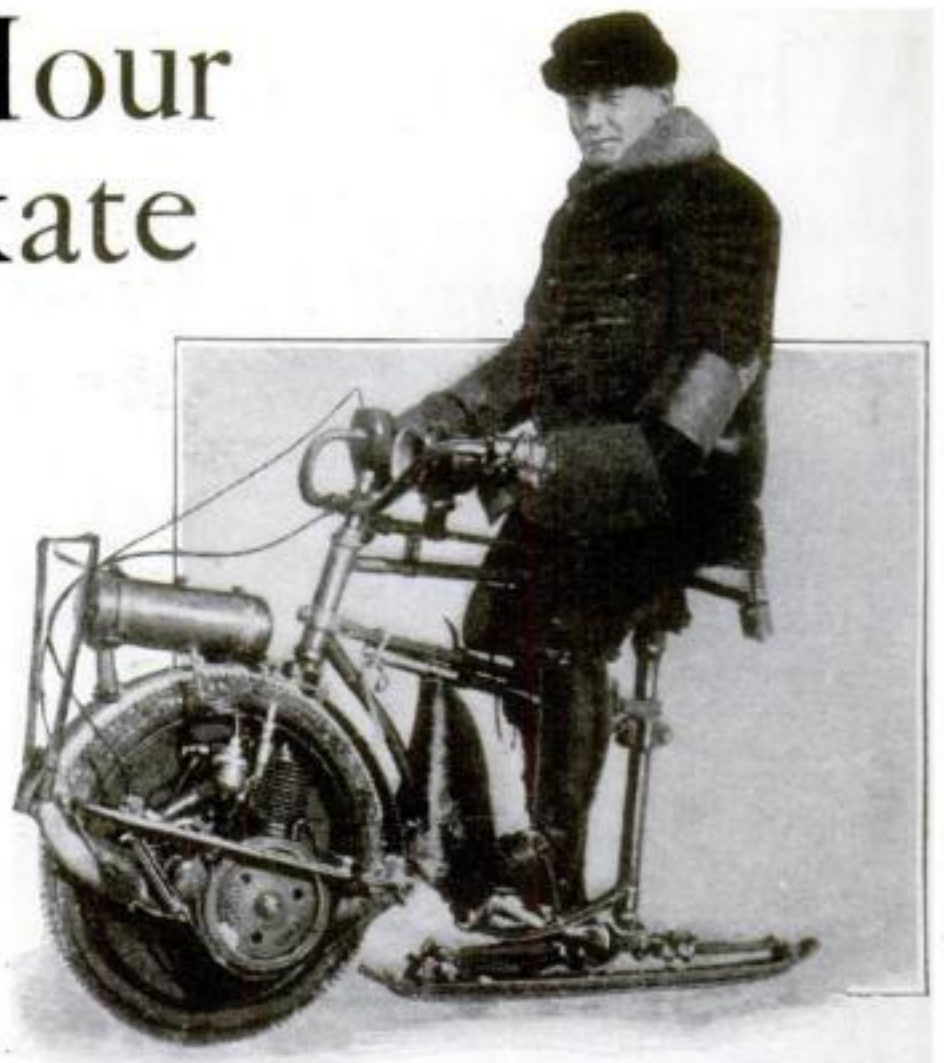
runner to be substituted for the rear wheel. This would reduce friction and permit sharper turns.

"My first machine was not successful. Nor was the next or the next. I must have built a score of them. But I was convinced that the idea was sound and I kept everlastingly at it. And that, I have learned, is the true secret of any success in invention.

"I got a job as a night watchman that I might have my days free to work in the little corner I had rented in a machine-shop. All the money I could possibly save went into materials. Every waking hour I could spare from my work went into labor on my device."

Over the rubber tire of a motor wheel Avoskan fitted a leather belt studded with steel spikes about one-half inch long. He attached a rear runner so that it could be controlled by the handle-bars, and so that it would turn in a direction opposite to that in which the bars were turned.

The runner was built like a ski, tapering in width from two inches in front to one-half inch in the back. This was for use on the snow. For ice he fitted a keen



**The Product of a Dozen Years' Work**

Thomas Avoskan, night watchman in a New York skyscraper, riding his latest ice-cycle. It is driven by a power wheel with spiked tire, and represents 12 years of experiment, and the building of about 20 models

steel skate to the bottom of the snow runner. This could be detached quickly.

It was a great day for Avoskan when his machine finally triumphed on the ice of Lake Placid. It went 50 miles an hour and ran 60 miles on a gallon of gasoline. He found it would easily pull 10 skaters in line.

**N**OW Avoskan has another idea. Without the weight of a rider, he believes, a machine would go still faster and pull even more skaters. So now he has attached a steering wheel to another type of motor wheel, fitted with a leather steel-spiked belt. Instead of sitting on the machine, the driver stands on the ice, wearing short skis on his feet. The machine has a clutch like an automobile, so that the engine can run while the wheel stands still. This machine, Avoskan confidently believes, will pull 28 skaters, and go 135 miles on a gallon of gasoline.

## "Waterfall" Runs Railway Car

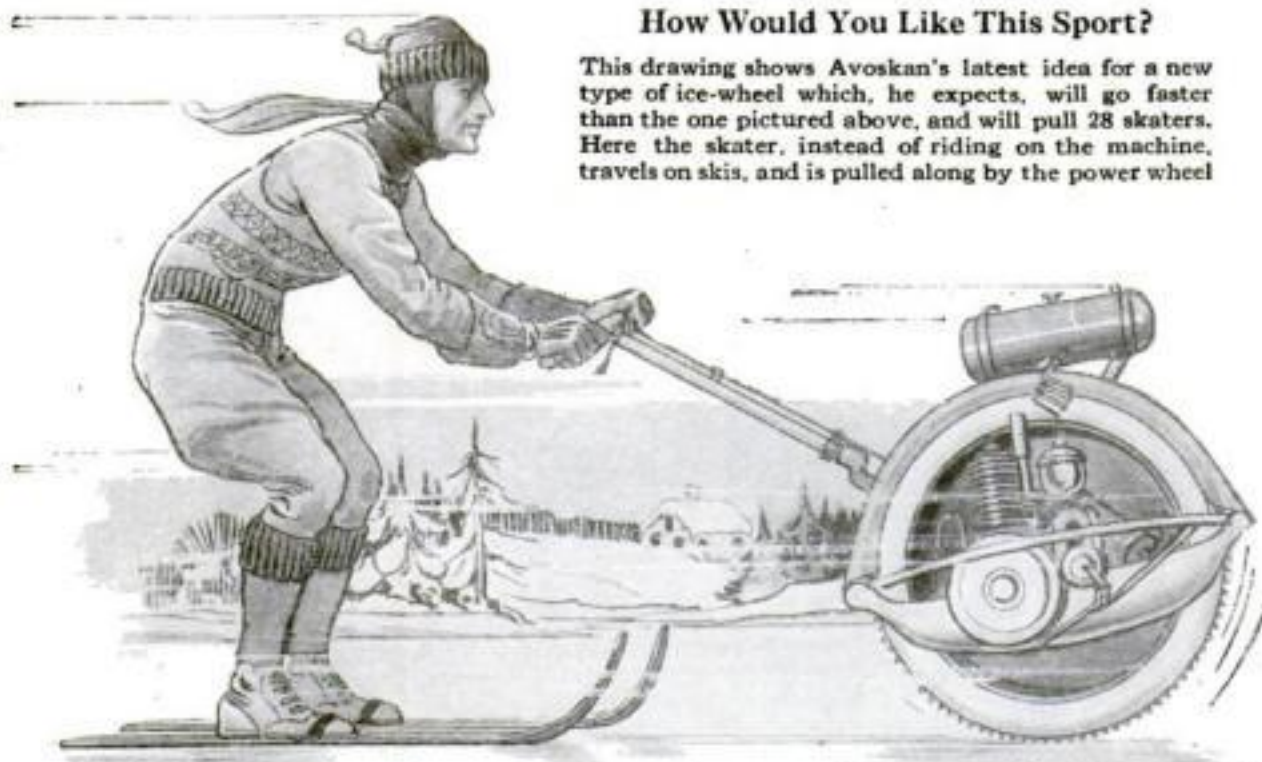
**A** NEW railway car in Sweden carries its own private waterfall to run itself by a water turbine. It has an internal-combustion motor of the usual type, but instead of using gears or electric transmission, the motor operates a centrifugal pump. This supplies water under pressure to a turbine geared to the driving axle. The speed of the car is governed by the height of the artificial head of water created by the pump.

With a 180-horsepower motor the car goes 50 miles an hour, and jerks are said to be eliminated.

Swedish railroads already have ordered the manufacture of four motor railway cars equipped with the new hydraulic drive.

## How Would You Like This Sport?

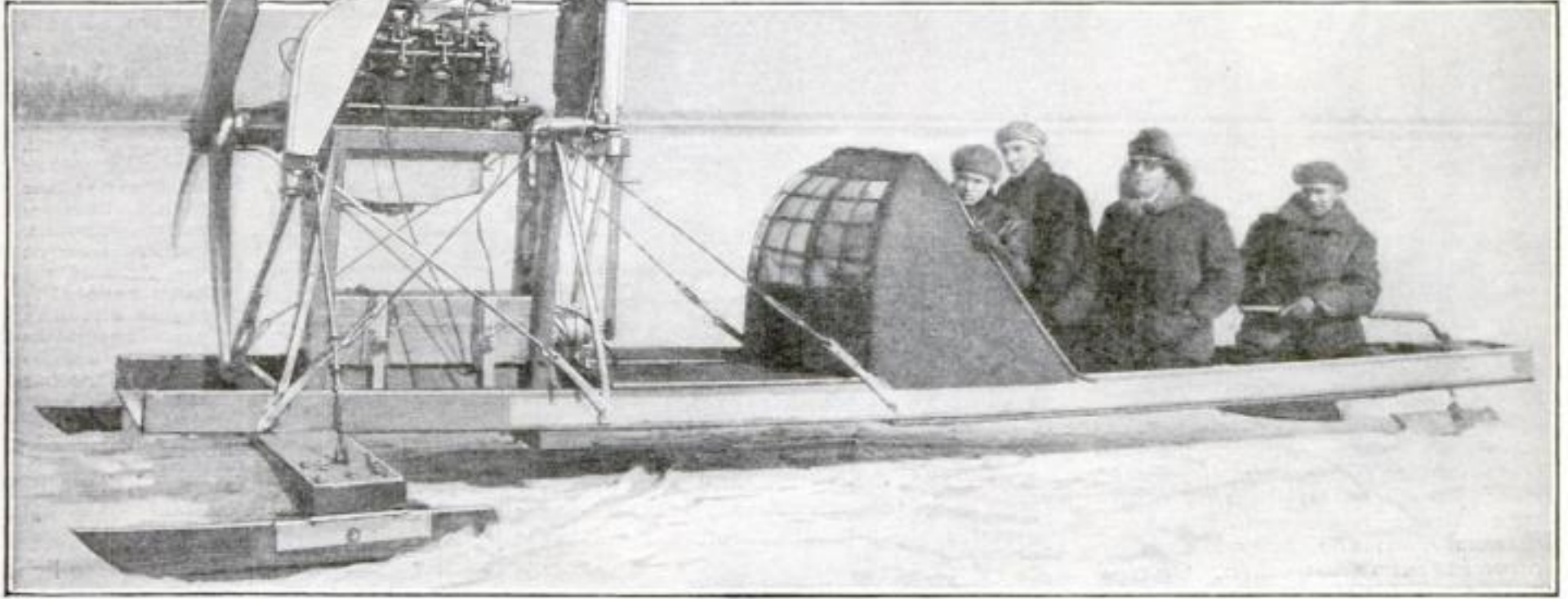
This drawing shows Avoskan's latest idea for a new type of ice-wheel which, he expects, will go faster than the one pictured above, and will pull 28 skaters. Here the skater, instead of riding on the machine, travels on skis, and is pulled along by the power wheel





# Sleigh and Ice-Boat Motorized

*Neither Cold nor Snow Can Halt These Carriers*



## Propeller Drives Speediest Ice-Boat

Driven by a 100-horsepower airplane motor, the "Winnebago Flyer"—said to be the world's fastest motor-driven ice-boat—travels at a speed of 85 miles an hour. The boat was built from a design suggested by J. Buckstaff, holder of the international ice-boat championship, and is owned by Dr. T. D. Smith of Neenah, Wis. It can carry six persons

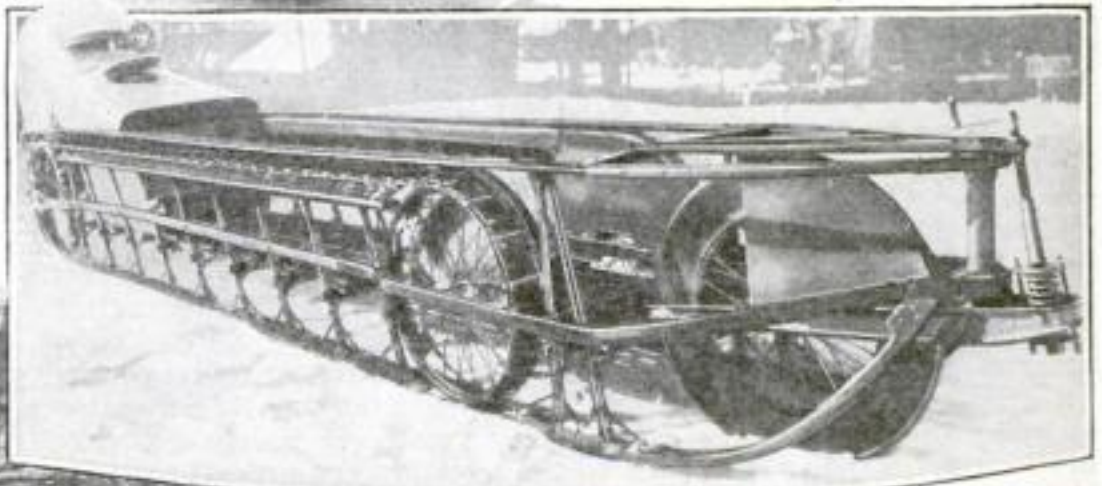
## Odd Tractor Conquers Snowdrifts

Across snowdrifts five feet deep, this queer-looking tractor hauled a load of logs weighing 20 tons, in remarkable tests in northern Michigan. In doing so it packed down the snow to form a roadway for other vehicles. In place of the ordinary tractor wheels are two revolving steel drums fitted with spiral "skates" or steel projections that provide the needed traction



## Auto-Sleigh May Replace Dog Teams

The motor-car, the Alaskan basket dog-sled, and the U. S. Army tank are combined ingeniously in a remarkable vehicle for transporting mail and passengers in the Far North. The machine, shown below and at right, travels on wide steel runners beneath which run endless treads moving about wire wheels at front and rear. Power plant and driver are carried at the rear. Steering is accomplished by an adjustable steel disk at the extreme front. The sleigh can travel 16 miles an hour





# Radio "Lighthouse" Now

## Marconi's Latest Creation—



### Where Radio Beams Pierce the Fog

Marconi's great radio "lighthouse" at South Foreland, England. The buildings at the left house the transmitter, generators, and auxiliaries. At the right is the huge revolving frame antenna which sweeps the sea with a radio beam, signaling warnings and directions to shipping.

*The scientific progress of the world is being made in an amazing number of units—never-ending contributions from the busy minds of inquiring men and women. On this and on the following page you will read of discoverers who are increasing the sum of human knowledge.*

**T**HE officer in the chart house of Marconi's yacht *Elettra* listened at a wireless receiver. "P-T-B-T," he repeated. Turning to a chart he pointed. "This is where we are," he said.

It was a practical demonstration recently of the latest marvel of radio—Marconi's new wireless "lighthouse" that sends out warnings to guide ships at sea. Senator Marconi was taking a party of government officials, shippers, and reporters on a cruise of the English Channel to demonstrate his marvelous system designed to assure safety on the seas never before dreamed of. For wireless now breaks through enshrouding fogs and high storms that many a time have kept light beams from giving adequate warning.

**T**HE short-wave-beam wireless system, which makes possible the wireless "lighthouse," is a development of directional wireless transmission. Morse dot-and-dash signals are projected in a narrow beam of about 15 degrees, the letters of the signals changing as the beam swings slowly in a circle.

On the ships, the observing officer hears a series of five or more Morse letters as the beam sweeps slowly past. By referring to a chart that shows directions corresponding to the letters, he can get his exact bearing, which corresponds to the middle letter of the series that he heard.

The signals are entirely independent of other wireless installation on a ship. Being transmitted on very short wave length, the signals do not interfere with the working of any commercial wireless stations in the vicinity. The receiving instruments can be operated merely by closing a switch. The apparatus is said to be so simple and inexpensive that it will be used on tugs and fishing-boats.

The complicated part of the apparatus is the transmitting station on land, located at South Foreland lighthouse, consisting of a vacuum-tube transmitter,

generating machines, and auxiliaries, with a huge unidirectional transmitting aerial system mounted on a revolving steel framework.

### Music Played in Colors

**W**E OFTEN have heard music described as "colorful." Now music in colors has become an actual fact. A machine recently invented by M. R. Ulrich of Portland, Ore., projects music on the screen in the form of color-patterns that change in delicate shade and form according to changes in the sound vibrations of melodies or harmonies being played or sung.

By a system of modulation, based on somewhat the same principle as that employed in transmitting pictures over telephone wires, the sound vibrations of the music are transformed into electric waves, which control the projection of color records on the screen. Each record is made on a glass disk.

The inventor and his remarkable apparatus are shown on page 35.

### New Marvels in Light

**E**LECTRIC lights so tiny that it would cost only a cent for current to keep them burning for an entire year, were discussed as possibilities at a recent meeting of the Illuminating Engineering Society in Detroit.

### The Beam Antenna

Here is a close-up view of the "lighthouse" transmitting aerial system, showing how it is mounted on a revolving steel framework. This beam system comprises a number of energized aeri-als in straight-line formation, together with reflecting aeri-als

Lamps without filaments, being filled instead with a gas that glows when subjected to a charge of electricity, also were described. The gas can be made to light in any color of the spectrum, according to D. McFarlan Moore and L. C. Porter, of Harrison, N. J., who have been experimenting with the new method of illumination.

The lamps can be used as indicators, serve as night lights, and are valuable in traffic and sign lighting. The most interesting use to which they can be put, it is reported, is in the transmission of pictures by wire and radio. While the





# Guides Ships

## Other Unusual Ideas

ordinary lamp burns a moment after the switch is off, because the filament cools slowly, the new lamp goes out instantly.

### Creating a New Meat Supply

ARCTIC explorers have been emphasizing for years that there is wealth in raising animals in the great northlands.

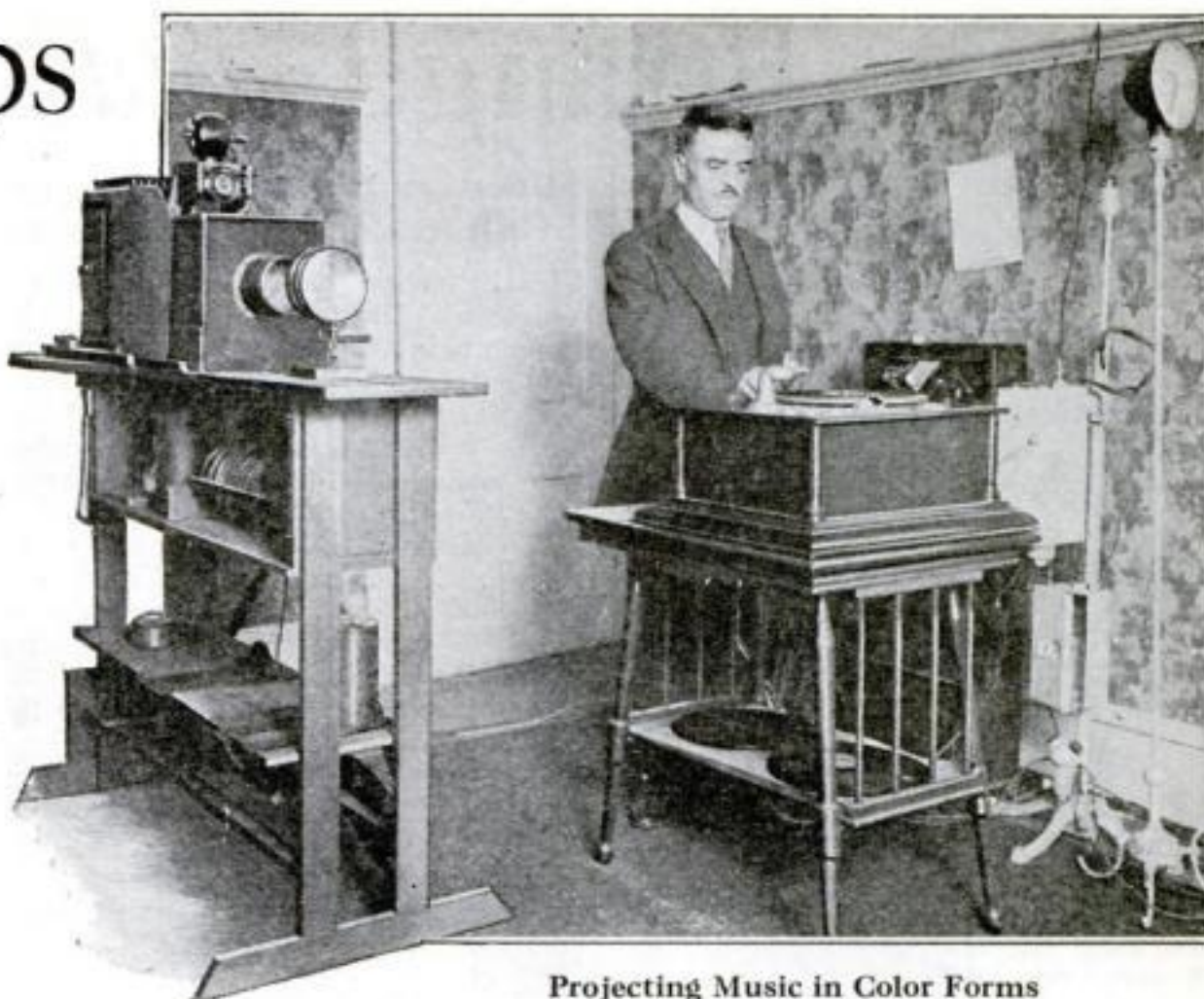
Now comes word that the Canadian government has appreciated the possibilities of its vast northern territories as stock lands and in Buffalo Park at Wainwright, Alberta, is carrying on a daring experiment of crossing the American bison or buffalo with domestic cattle. The result of the cross is a valuable new breed of hardy cattle called the "cattalo," that will range wild in the north.

Feeding themselves, great herds of cattaloes, it is expected, will increase at no expense, as long as the northern plains remain unsettled, repeating the history of our own prairie buffalo. It is too cold in the north for ordinary domestic cattle unless shelters are provided for them and they are fed artificially. Buffaloes, however, will thrive in these regions, foraging for themselves and needing no shelter.

The experiments in Alberta seem to have resulted in an animal possessing the hardiness of the buffalo, yet carrying on its back a larger supply of meat. This is far more pleasing food, it is claimed, than the buffalo of pioneer days in America.

Officials recently sent samples of the meat of a fully grown cattalo bull to 25 families. Sixteen approved of it, and the number would have been much greater, it is believed, if the meat of a young animal had been tested.

The hide of the cattalo is an improvement over that of the buffalo in quality, durability, thickness and length of hair,



Projecting Music in Color Forms

M. R. Ulrich, of Portland, Ore., with his remarkable apparatus for transforming music vibrations into color patterns projected on a screen. The photograph shows the color projector hooked up with a phonograph. All records of this music-color instrument are made on glass disks

and so offers a valuable new leather supply. At the same time it provides better protection for the animal from the cold.

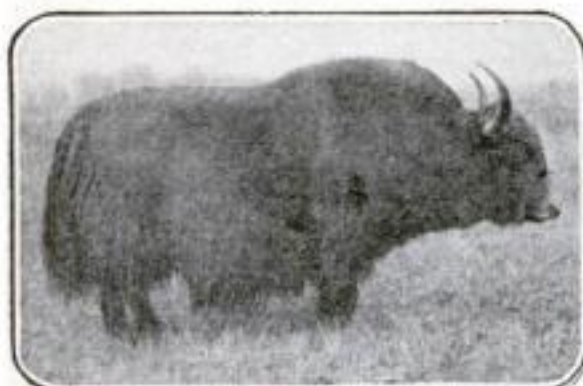
Angus, shorthorn, and Hereford cows were used in the first matings with the buffaloes.

Experiments now are being made, too, in crossing the buffalo with the yak, a draft animal from Asia. Yaks are splendid range animals, capable of withstanding the effects of long, rigorous winters in the open, and at the same time they are domesticated. Their meat, except that it is finer grained, is almost identical with beef. The natives of Asia have crossed the yak with domestic cattle

successfully for many years. Now this yak-cattle hybrid is being crossed in Canada with the bison.

Less than 20 years ago the Dominion of Canada had but a handful of buffalo and, as in the United States, it was feared these fine animals would become extinct. Today purposeful breeding has increased the number to more than 11,000. In fact, the animals are increasing so rapidly that in 10 years it is expected that the herd will exceed 50,000.

The government has spent \$2,000,000 in its project to stock the plains with buffaloes. Its new scheme to set loose herds of cattaloes with valuable meat and hides will make up in a few years, it is thought, for this expense and will assure an ever-growing source of revenue.



The yak. Crossed with the bison (right), it produces the new hybrid shown below

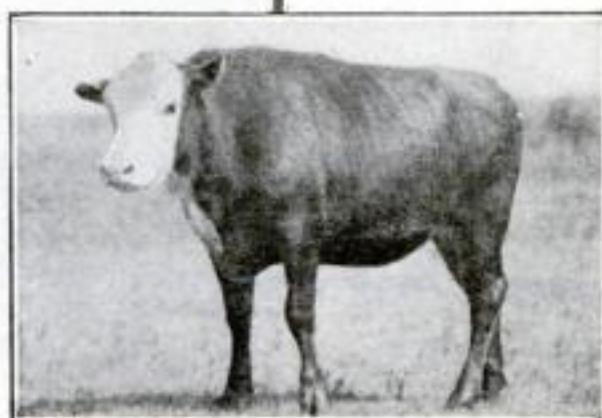
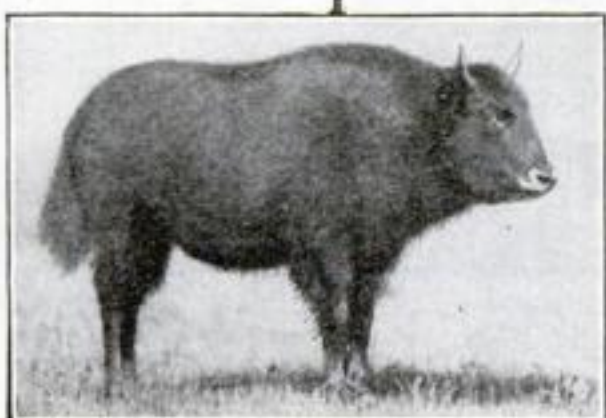


The American bison or buffalo, used in producing hardy new forms of beef cattle



The domestic cow. Crossed with the bison it produces the rangy cattalo shown below

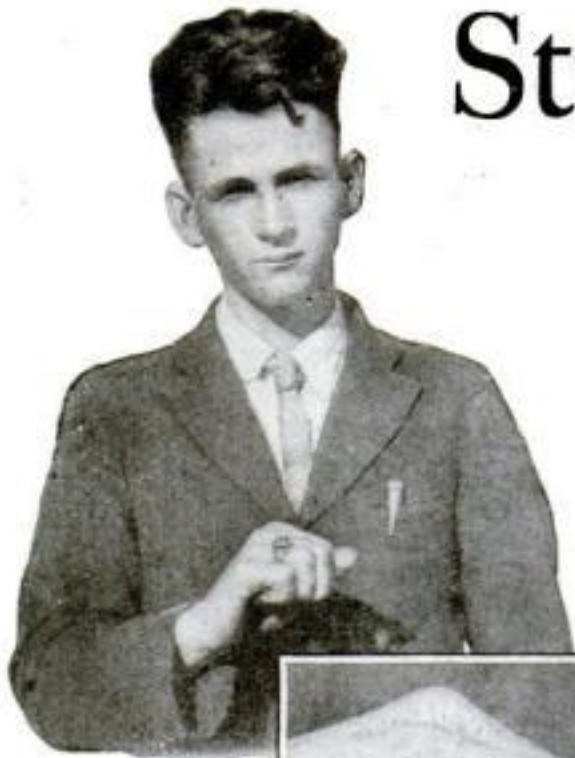
The yak-buffalo inherits the hardy qualities of both the yak and the bison, as well as the fine grained meat of the domesticated Asian draft animal



The cattalo, a valuable new breed of hardy meat cattle, produced by the crossing of bison and domestic cow. Its meat is said to be of high quality



# Strange and Interesting



Mounted on a finger ring, this little motor runs at high speed on two volts. It was built by a high-school boy, Eugene Reinbold (above) of St. Paul, Minn., in his spare time



## Boy Builds World's Smallest Electric Motor

**A**N ELECTRIC motor, so small that it has been mounted on a ring, has been completed by Eugene Reinbold, of St. Paul, Minn.

The motor is one-fourth of an inch high and weighs less than a quarter of an ounce. The armature was made of a section of a nail, which was drilled and the shaft of the drill cut off and left in the armature to form the shaft. Two and a quarter inches of wire was used on the armature and six inches on the field coils.

The commutator is of thin sheet bronze, attached to the shaft with shellac and a silk thread at each end. The brushes are about an eighth of an inch long and were made from Christmas-tree tinsel. The motor runs at a high speed on two volts and can scarcely be heard. Reinbold is a senior in high school.

## Man Finds Smallest Oil Field in His Poultry Yard

**W**HAT is said to be the smallest oil field is owned by H. E. Lundquist of Willcox, Ariz. An oil scum forming on his well water caused Lundquist to test his poultry yard for indications of petroleum. With a soil auger about two inches in diameter he bored down as far as possible. He then screwed sections of pipe to the top of the auger stem and kept on going until he got down about 18 feet in an ordinary water sand.

Thirty or 40 similar holes were bored and in a few hours these filled up with fluid that resembled a good grade of gasoline. By going from hole to hole, Lundquist was able to pump from two to five barrels of gasoline a day. He is now storing it in drums.

According to the geologists, the gasoline seepage apparently is a migration from a near-by main pool of oil.

## Miniature Steam Hoisting Engine Operates on Its Own Power

**T**HE engine of the steam hoisting engine illustrated at the right, though only two inches high, is operated by the power it develops itself.

It was built by Henry C. Stoll of New York City, and is said to be the smallest ever made. The boiler of this amazing bit of mechanism is five-eighths of an inch high and its cylinder but three-sixteenths of an inch.

The main shaft is mounted on the inside, projecting through, and carries the armature, operating the fly-wheel and crankpin.

The designer is shown at the right, adjusting the tiny engine.



Tiny hoisting engine and its inventor

## Woodcarver an Expert Seismologist

**D**URING the day Raffaele Bendandi is just a woodcarver of

sunny Italy, who earns enough by his labors to support his aged father and mother.

But when evening comes Bendandi works with the passion of the explorer in search of the unknown, for his night avocation is seismology, the prediction of earthquakes. He works until long after midnight in his "observatory" in the basement of his shop, and gets up about five each morning. From his earnings as a woodcarver he purchases his technical books and apparatus.

Although only 31 years old, he has attained a reputation for mathematical accuracy in forecasting earthquakes well in advance.



Homemade suit of dyed husks

## He Made His Summer Suit of Husks

**I**T WAS unbearably hot in Missouri. John Melton, a bachelor farmer near Carrollton, found even overalls too hot. It seemed to him that his dog kept cooler than any one else on the place, by lying in the shade of the cornfield. John turned to the cornfield, too.

He gathered corn husks, colored some blue, some red, braided them together, and made the outfit illustrated at the left. When he goes to town, he attracts more attention than the most vivid flapper. The suit has other advantages, too. There are plenty of air holes for ventilation and it can be washed with a hose without damage.



Poultryman pumps five barrels of gasoline a day from his chicken run



# Things People *Are* Doing



## London Has Expert Taster to Sample Water

WE HAVE had expert tea tasters and coffee tasters. Now comes the official water taster. He is employed by the Metropolitan Water Board of London, England, to sample and test the water supply used by the seven million Londoners for daily consumption.

This official is an expert chemist who has trained his sense of taste especially for the unique job. To this end he abstains entirely from smoking, from liquor, and from such food as might impair this highly developed sense. He usually chews an apple before work.

## Visiting the Land of Pygmies

THREE scientists are off to pygmy land to study the lowest race on earth—the "Small People" who inhabit the Kalahari Desert of Bechuanaland. They do not swing from trees, but, according to Dr. C. E. Cadle, leader of the expedition, their resemblance to the higher apes is remarkable. Their scientific importance is that they are the only race on earth that has not acquired at least one habit of the white man. Their home swarms with insects and reptiles in the wet season and water is almost unobtainable during the dry season.

With his companions, Dr. Grant H. John and Paul L. Hoeffler, Doctor Cadle will live a year with these strange people, observing their habits and customs.

## Young Artist Creates Novel Fretwork Pictures

INSTEAD of paints and brushes, Lettice Apperly, a 16-year-old artist of Maida Vale, London, uses wood and a fretsaw to fashion remarkable pictures. Her creations, which have brought her considerable fame in England, include human figures, animals, and flowers fretted out of wood with marvelous detail and placed on painted backgrounds. So effective are her fretwork pictures, that a large factory is employed in duplicating them in large numbers.

Lettice Apperly, 16-year-old London artist, making one of her remarkable fretwork works of art



THE MOST prominent figure in modern psychoanalysis, Dr. Sigmund Freud, is planning a motion-picture film that will express his teachings in popular form. Psychologists in America have expressed their interest in the novel undertaking.



## He Reads Records of Past Ages from Dinosaur Footprint

MR. C. W. GILMORE, of the Smithsonian Institution, Washington, D. C., is seen here studying a huge footprint left by a dinosaur in the soft clay of what is now Virginia, some 10,000,000 years or so ago. From fossil footprints such as this Doctor Gilmore reads the records of ages long before there are any traces of man.

## Girl Explorers Cruise 1700 Miles in a Sailboat

INTEREST in archeology and love for adventure recently took two young French girls, Mlle. H. de Saussure and Marthe Oulié, on a remarkable voyage of 1700 miles among the islands of the Greek Archipelago. In a 23-foot sailing cutter, the *Perlette*, navigated entirely by themselves, they cruised the blue waters made famous by the story of the wanderings of Odysseus.

Neither of the girls is much more than 20 years old. Mademoiselle Oulié, described as the youngest archeologist in France, was commissioned to make excavations in Crete by the Académie des Inscriptions et Belles Lettres.

In more than three months they spent only one night ashore, and they anchored in 50 ports.

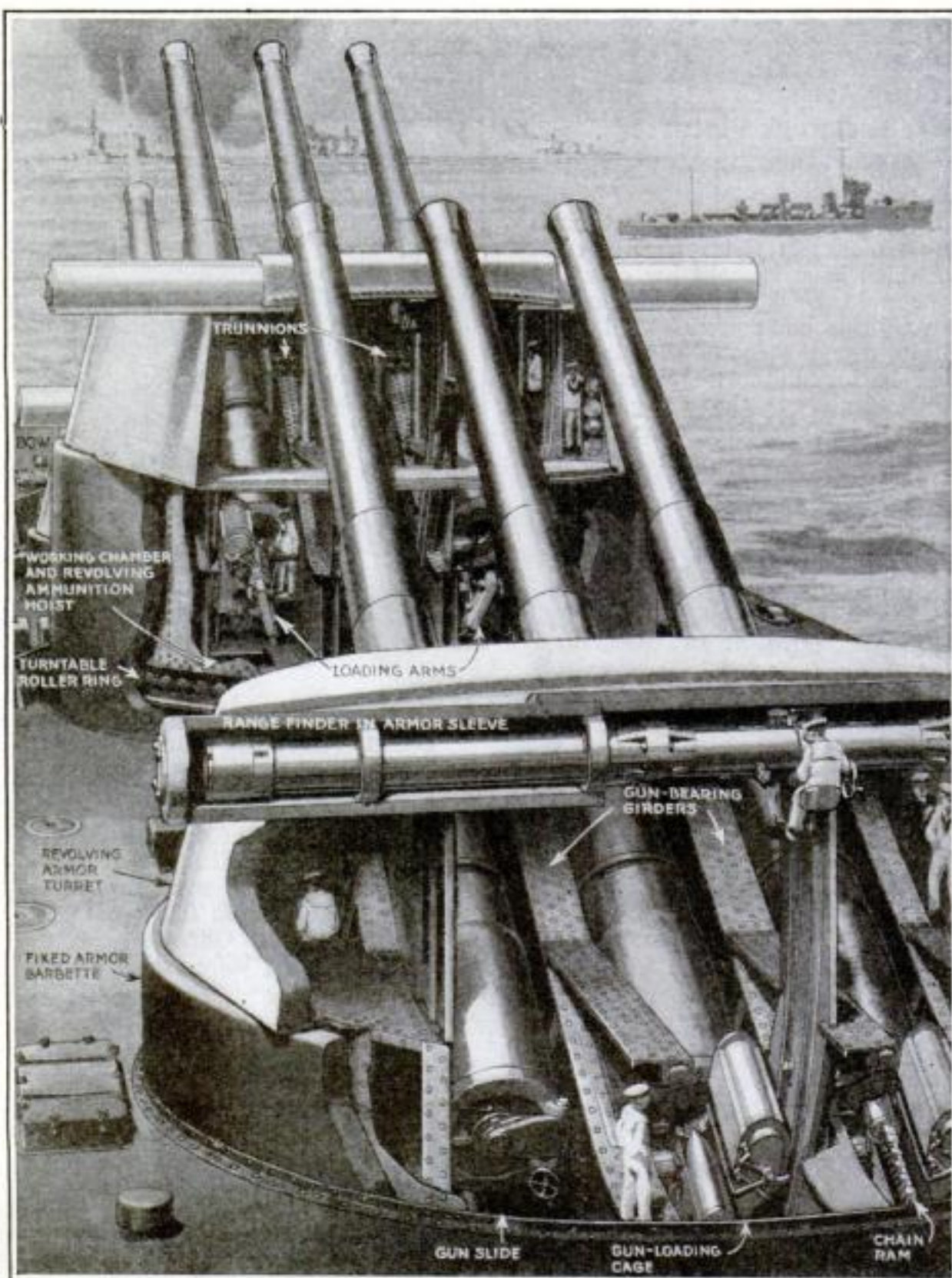
The most exciting and satisfying result of the cruise of the two young scientists was the discovery and unearthing of the ruins of Malia, a city built about 4000 years ago, that for centuries had lain buried.



Mlle. H. de Saussure, who captained the 23-foot sailboat for 1700 miles through the Aegean Sea with another girl, Mlle. Marthe Oulié, for crew. The two intrepid girls were on a voyage of archeological exploration



## Huge Guns for England's Newest Battleship



How the tremendous armament of nine 16-inch guns will be ranged in three revolving turrets aboard the British battleship *Nelson*. Each of these guns will fire a projectile weighing a ton

**C**AN you imagine nine tons of death-dealing metal being hurled for nearly 20 miles in a single broadside? Such an almost unbelievable blast of huge projectiles will occur whenever Britain's magnificent new 35,000-ton battleship *Nelson* lets loose her big guns.

For the *Nelson*, newly launched, will have the most powerful armament of any battleship in the world. The drawing above shows the immense proportions of this armament—nine 16-inch guns mounted in three turrets. And each of these huge guns will fire projectiles each weighing more than a ton. In addition, there will be a secondary armament of six-inch guns.

The illustration shows the backs of the turrets cut away to expose the design of their interiors, in such a view as the commander will see from his conning tower. All guns, mounted in these mighty revolving houses, will be able to fire on either broadside. The fact that the big guns are located in the central part of the ship, leaving a tremendously long forecastle, is of interest in view of a

recent unofficial statement that the *Nelson* will carry an unusual number of airplanes.

In accordance with the Washington Armament Treaty, the *Nelson* will replace two previous battleships.



### Acreage of Crops Measured by Automatic Device

**T**O OBTAIN accurate measurements of the number of acres planted in various kinds of crops, an automatic recording device has been perfected by D. I. Floyd, agricultural statistician of the U. S. Bureau of Agricultural Economics. He is shown using it to measure fields of corn and cotton in the South.

The apparatus is used on a train, and operates much like a speedometer. When the train comes to the field to be measured, the operator pushes a button that sets the measuring mechanism in motion. At the end of the field, another button stops the mechanism, and the total distance is read on the instrument board.

### Highway Bumps Give Warning of Railway Crossing

**R**IDGES of concrete laid across the road are the latest idea for warning drivers that a railroad crossing is close at hand. If a motorist won't heed the usual warning signals, the idea is to shake him into a realization of danger.

This new type of safety warning, recently tried out in California on a highway running between Petaluma and Santa Rosa, consists of two risers about two inches high, extending the width of the road, about 50 yards from the crossing.

A report of grade-crossing accidents recently made by the Pennsylvania Railroad for four months showed that of 682 accidents, 487 occurred in broad daylight. Seven fatalities and 17 injuries were due to attempts to beat trains over crossings. Fourteen fatalities and seven injuries occurred where warning bells were ringing.



The latest idea for safety warnings at approaches to a railway crossing—two concrete ridges about two inches high extending the full width of the road 50 yards from the crossing



# Ingenious Rocking Frame Loads Trucks Automatically

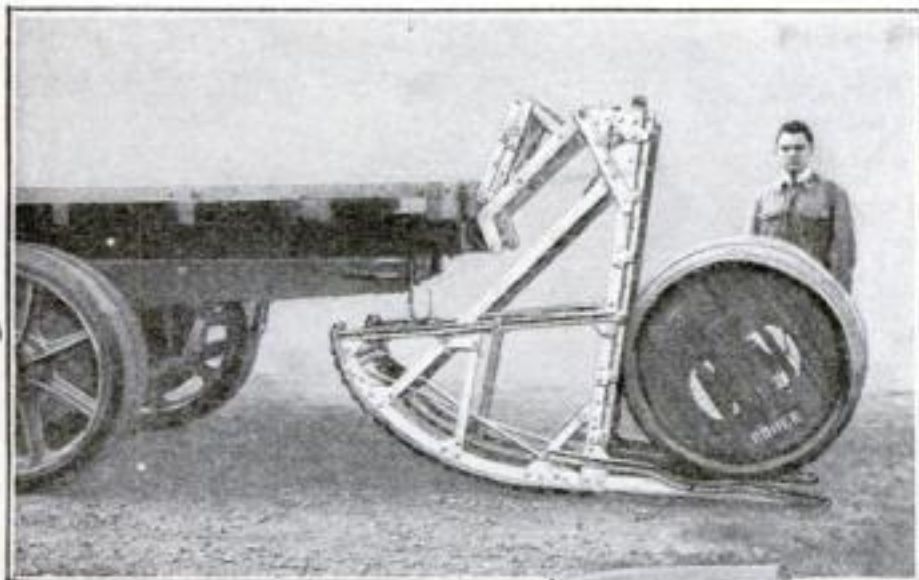


Fig. 1. The barrel first is rolled on the loading platform cradle

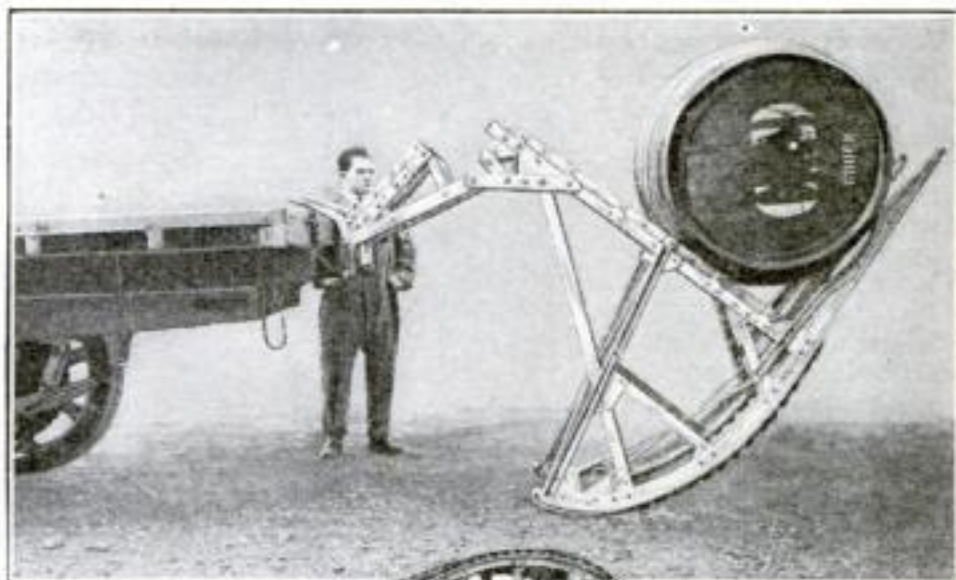


Fig. 2. As the truck moves slowly forward, the barrel is lifted

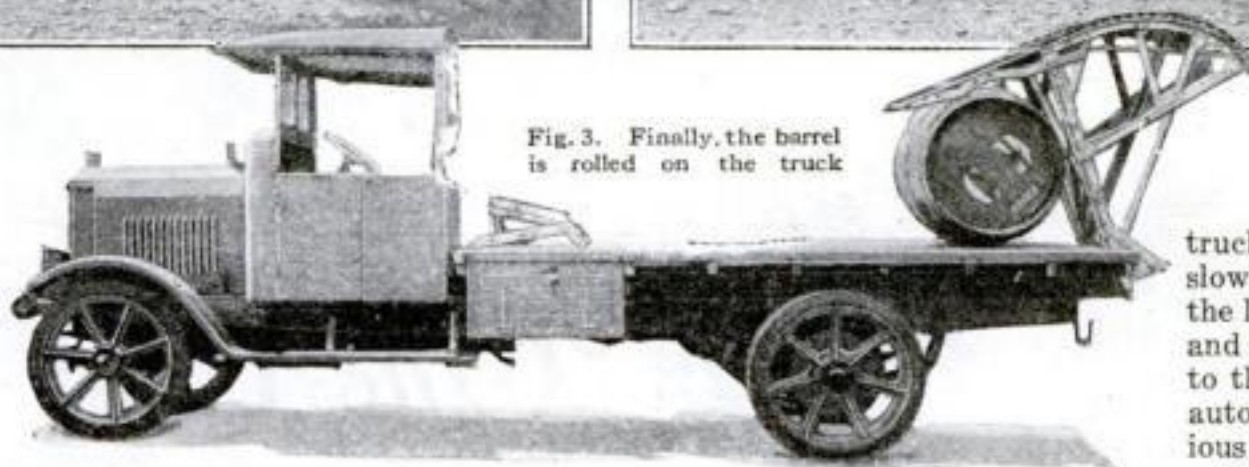


Fig. 3. Finally, the barrel is rolled on the truck

**EVERY** one has seen heavy barrels being loaded on a truck by hand labor. The barrel ordinarily is pushed up an inclined runway by five or six husky freight handlers. It was in order to eliminate this heavy labor that a French inventor has perfected a novel mechanical truck-loader that does all

the work alone, requiring but one man to guide it.

The barrel first is rolled on the end of the loader, as shown in Fig. 1. As the

truck is driven forward slowly, the barrel is lifted to the level of the truck body, and then rolled forward on to the body. This is done automatically by an ingenious rocker arrangement.

Square boxes may be loaded in a similar way, except that they are placed on small platforms fitted with casters and carried to the loading platform.

## New Electrical Device Measures Altitude

**A** NEW instrument that measures altitude electrically and about eight times as accurately as the ordinary barometer, to a height of at least one mile, recently was shown before the French Academy of Sciences. The apparatus is based on the fact that a heated object cools off much more quickly in dense air than in very thin air or near vacuum, because in a near vacuum there is very little matter to conduct or convey the heat away. The density of air depends on the altitude, so that by measuring air density the instrument also gives a measure of the altitude.

The device consists of a wire of great resistance, so that when an electric current is passed through, a high temperature can be obtained.

### Rich Diamond Bed Found

**A** MAGNIFICENT new diamond "pipe" recently was discovered at Mwanza, Tanganyika Territory, Africa. The diamonds are said to be unusually large, pure, and plentiful. A diamond "pipe" is a soft claylike mixture, formed by some ancient volcano, in which diamonds are found. Diamonds are the product of intense volcanic heat.

## One Way to Stop an Automobile's Splash

**I**N AMERICA, motorists splash and let the other fellow growl. But in Paris they have more consideration for people's

feelings or clothes, and offer a yearly prize for the best device to stop an automobile from splashing mud. Illustrated is one of these inventions recently entered in the contest.

Two rubber disks with an oblong rubber piece in the center are attached to each wheel. The disks revolve on contact with the ground and, being very flexible, pass over obstacles easily. Because of their flexibility they are not harmed when brought in contact with the curb.



A new idea to prevent splashing. Flexible rubber disks attached to each wheel, shield pedestrians from flying mud and water

## Know Your Car

**T**HERE is just one way you can drive your car in safety when the streets are covered with sleet and snow. That is to fit a pair of skid chains to the rear wheels. The same thing applies on country roads that are deep in mud.

Chains do little if any harm to the tires when properly attached. Of course, you must keep a close watch on your chains, replacing the cross links when they begin to wear too thin, because a broken cross link will quickly remove all of the paint from the inside of your mudguard. Many a mudguard that rusts through long before its time was started originally on the road to ruin by the lashing of a broken chain link.

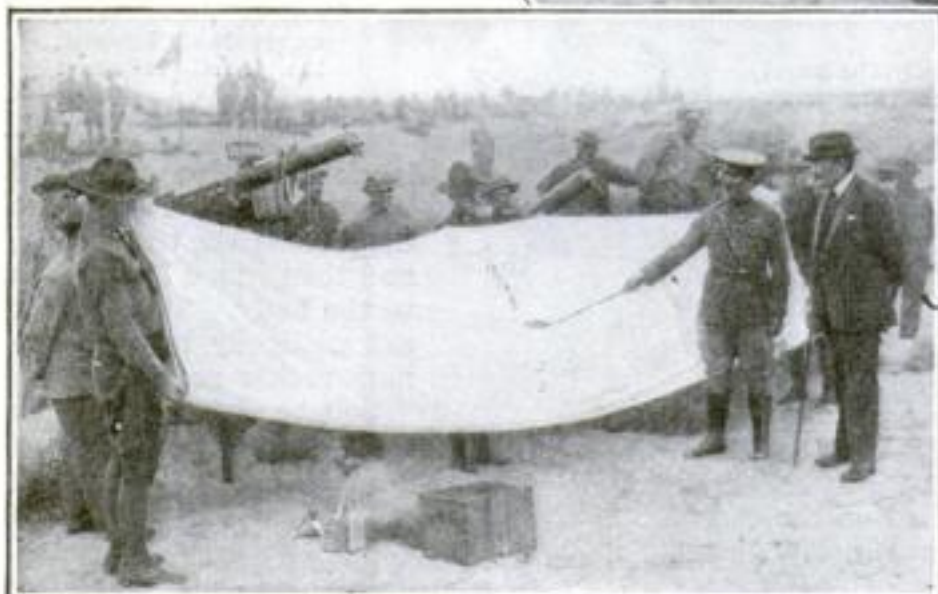
Observe these rules and you will get the best possible results from the use of chains:

1. Attach the chains carefully with just enough slack so that the chain will creep around and around on the tire. This prevents the cross links' cutting in at any one point.
2. Replace worn cross links before they break.
3. Keep your chains clean and wipe them with an oily rag occasionally.
4. Keep your tires a bit soft when chains are used, to prevent excessive vibration. This is especially important on light cars.



## New Anti-Aircraft Gun Tested

A powerful new weapon against aerial attack is this .50-caliber Browning anti-aircraft machine-gun that can shoot one-eighth-pound bullets four miles. During recent spectacular tests at Rockaway Point, N. Y., two targets towed by Martin bombers at an altitude of 2000 feet were shot down in three minutes, 18 seconds. Below: Maj.-Gen. Johnson Hagood, in charge of the test, is seen pointing out 22 hits scored on one of the aerial targets

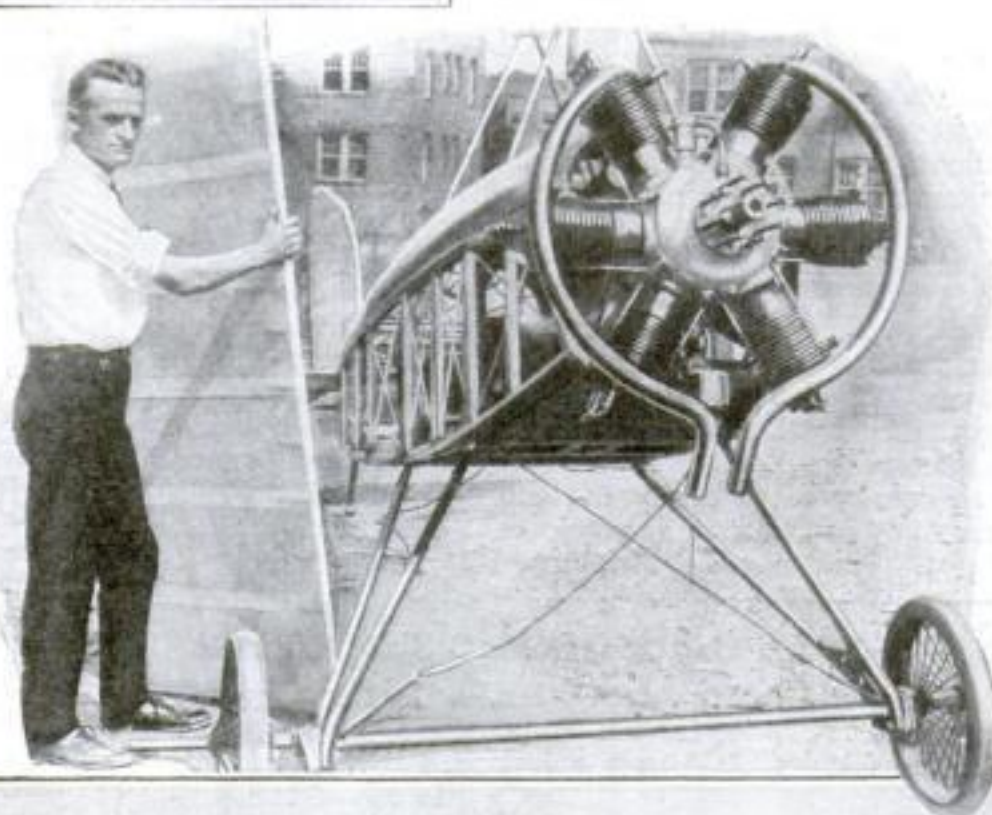


## The Last Word

*Remarkable New Fighting  
Planes Built for Sport,*

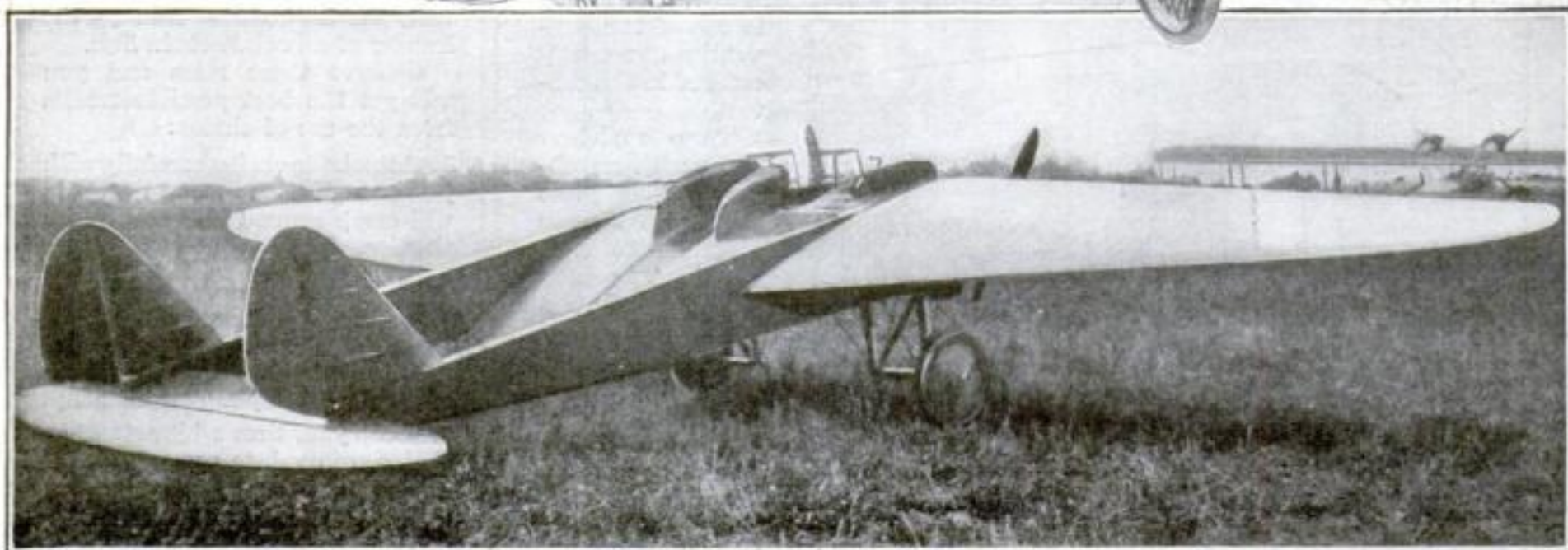
### Designs Backyard "Flivver" Plane

At the right is A. K. Peterson, pilot and chief photographer at the Naval Air Station at Anacostia, D. C., putting finishing touches on his remarkable new "flivver" plane which, he says, will be able to hop off from any back yard 100 feet long. The machine weighs less than 500 pounds and is designed to cover 400 miles on 13 gallons of gasoline. It is driven by a 40-horsepower motor. Its designer claims it will develop a speed of 100 miles an hour



### Unique Plane Has No Fuselage

The latest in French aircraft design is an unusual passenger monoplane (below), constructed without the ordinary fuselage. Instead, the wings and body of the machine are built as one unit. Backward from this unit extend two stringers that carry double rudders at the tail, and these rudders are bridged by a wide elevator. The machine is driven by two nine-horsepower automobile motors and has a speed of 90 miles an hour.







England's Newest Mother Ship

Converted from a cruiser, England's newest aircraft carrier, the *Furious*, is seen here leaving Plymouth on her trial voyage

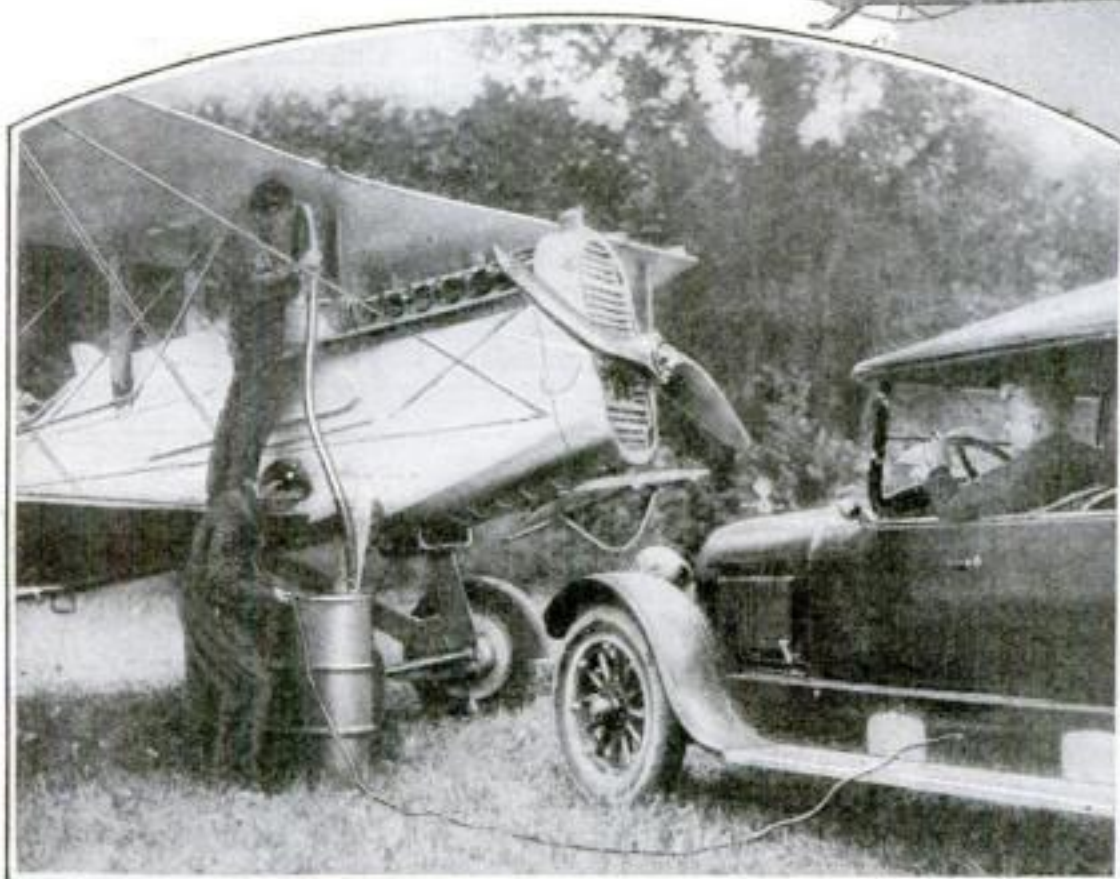
## in Aeronautics

*Machines—Passenger  
Economy, and Safety*



### Lever Drives Motorless Plane

Captain James E. Kempf of the U. S. Army Reserve Corps, Washington, D. C., has just completed this model of a remarkable motorless airplane, which he designed primarily for aerial sport. The machine would be driven by two flapping wings at the side, operated by the pilot pushing and pulling a lever. The full-sized plane, Captain Kempf says, would weigh 150 pounds, and would cost less than a popular-priced car

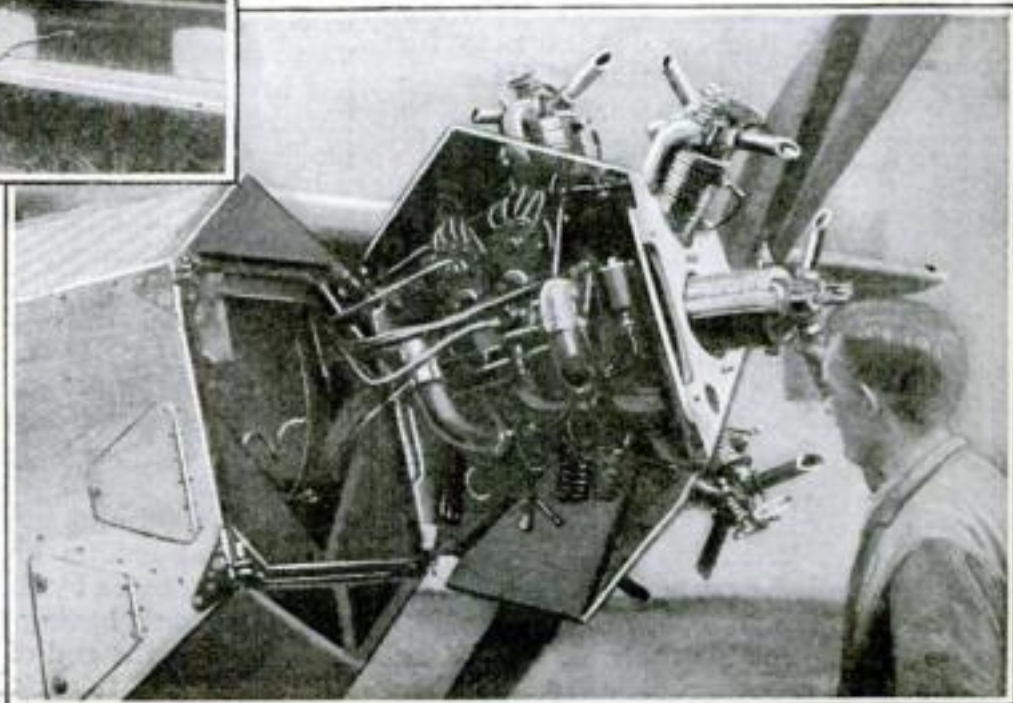


### Auto Pump Fills the Fuel Tanks

The task of filling an airplane's gasoline tanks has been simplified by this ingenious pumping apparatus driven by an automobile engine. Lieutenant H. Goddard is the inventor. The pump forces air into the gasoline drum, supplying pressure that lifts the fuel through a hose

### Hinged Motor Easy to Repair

A swinging frame for the airplane motor, designed to bring all parts within easy reach for inspection and repair, is a new German idea. The unique mounting is shown on the *Caspar*, a monoplane





## Portable Water Pump Driven by Small Car



Pumping out a sewer ditch with the portable apparatus driven by a Ford engine

**I**NGENIOUSLY attached to a Ford car, this handy portable pump can be used for draining out conduit tunnels, pumping out ditches, removing water from cellars after fire, or flooding, and furnishing water supply for roadbuilding, irrigation, or for small-town fire-fighting. A power take-off connects the pump with the automobile engine. Fastened on the frame of the car, the pump may be left running without strain or breakage to the car.

The pump is driven by means of a floating shaft from the motor and has a capacity up to 550 gallons. In the illustration above a pump is shown at work in a sewer ditch.

### Novel Electric Cigar-Lighter Is Made Foolproof

**L**IFTING the handle from the hook of this unique cigar-lighter automatically completes an electric circuit and produces a small flame. Replacing the handle extinguishes the flame.



Lifting the handle lights a small flame

The same circuit lights a bulb in the display globe at the same time, so that the device may be used also for advertising. The lighter is claimed to be foolproof, for if the user forgets to replace the handle on the hook and lets it drop, the weight of the handle breaks the circuit.

### Lamp in a Finger Ring

**A**TINY electric lamp in a finger ring is designed for writers, travelers, and patients in hospital wards. The lamp throws light directly upon a sheet of paper or a page of a book sufficient to read or write by.

### This Arithmetic Game Board Turns Study into Play



Vertner Brittingham, Denver school-teacher, with the game board he devised to make arithmetic a pleasure to learn

**"N**OW what's the answer?" asks the teacher, giving a spin to the arrows; and the class shouts, "Seventy-seven!"

The teacher is Vertner David Brittingham of Denver, Colo., who, convinced that playing arithmetic is the best way to learn it, has invented an arithmetic game board to make it real fun, and no longer a session to be dreaded.

Three arrows spin on a dial. Two point to numbers and one to signs of addition, subtraction, multiplication, or division. From these the pupils can read the problem.

Any number of players can play in the game, but interest is added by forming rival sides, as in a spelling match.

Each pupil in his turn spins the arrows and credits himself with the sum indicated by the arrows at rest. The side having the largest sum total at the end of the game, when all have taken their spins, is the winning side.



N. M. Sweesy, Los Angeles deputy sheriff, fitting his newly invented rubber shock absorber to the stock of his own revolver

### Shock Absorber for Revolver Saves Bruised Hands

**I**N RECENT target contests staged by the sheriff's office in Los Angeles County, Calif., to perfect officers' marksmanship, many of the contestants suffered from bruised hands. To prevent this, N. M. Sweesy, a deputy sheriff, has invented a recoil shock absorber for revolvers.

It consists of a rubber pad that fits on the grip of the gun. Because of its flexibility it will fit on any pistol or revolver.

### Electric Elevator Carries Fish over High Dam

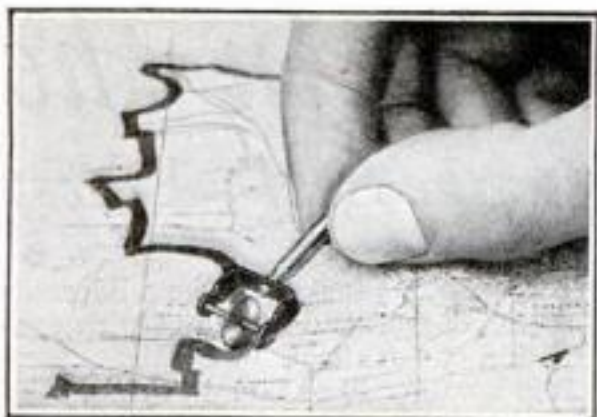
**H**OISTING fish in electric elevators over high dams is the ingenious idea of Prof. John N. Cobb of the University of Washington. It has been applied to a big power dam on the Columbia River.

A low spillway is made at the bottom of the dam. Fish jump this low falls instinctively, landing in a wooden chamber. Here they are scooped into a metal bucket that runs up and down a steep track, carrying them without water to the stream above the dam, where they proceed on their way to their spawning grounds. Experiments show that this short exposure to the air is not harmful.



How the fish ride over Columbia River dam





### Vest-Pocket Map Measurer an Aid to Autoists and Hikers

**H**OW far is it to the next town? A device that measures the windings of the road on a large-scale map is useful, especially for the hiker or motorist traveling on strange roads.

The instrument is only 1½ inch long and consists of a small toothed wheel turning on a screw-threaded bar. The wheel is set against an index pointer at one end of the screw, then run along on the map until the whole course has been traversed.

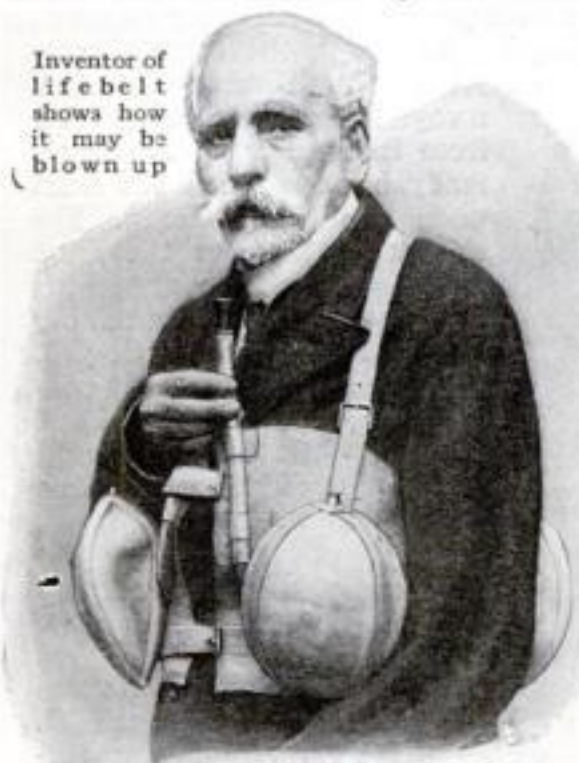
The map measurer next is placed upon the scale of the map and the wheel run the reverse way until it reaches its starting-point. The distance traversed then is obtained correctly.

SUN baths for everybody are made possible by the wearing of a new fabric that looks and feels like silk, yet that allows the sun's ultra-violet rays to pass through it.

### Improved Lifebelt Keeps Man's Head above Roughest Water

**"H**IS head can't sink," claims P. Guterman, the English inventor of this new lifebelt, explaining how the belt holds the wearer upright even though he be exhausted and in heavy seas. It consists of a band of canvas with four floats that are inflated by the wearer's

Inventor of lifebelt shows how it may be blown up



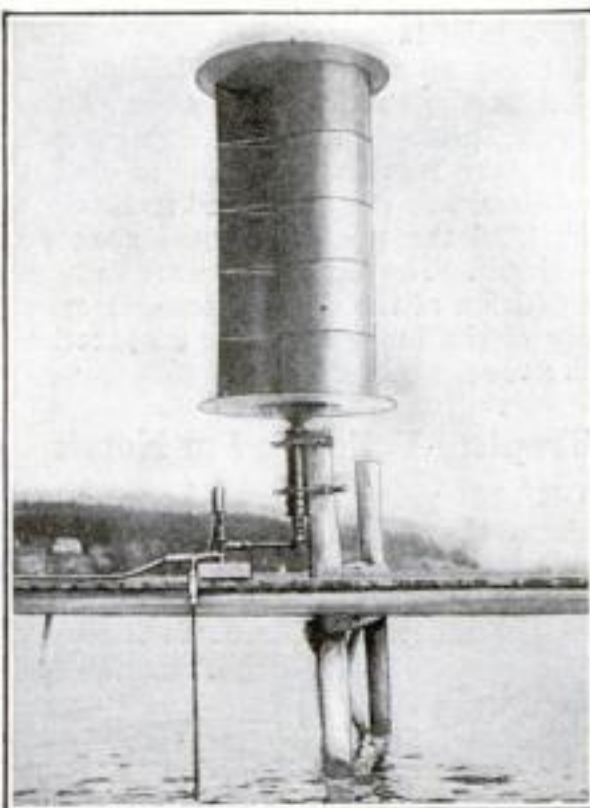
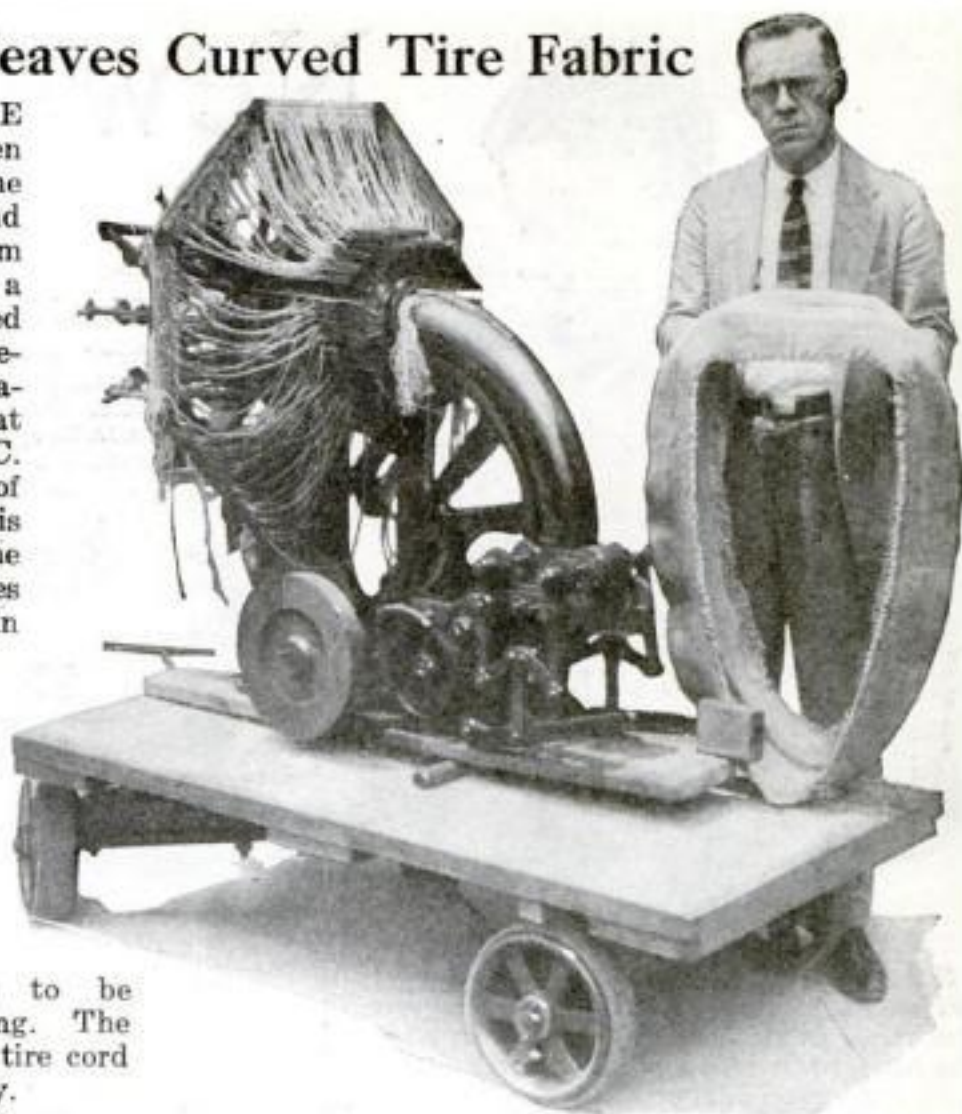
blowing through the tube, which is fitted with a self-closing valve and runs around the belt.

The belt can be worn under the clothing and does not prevent the wearer from swimming. The photograph shows the inventor wearing one of the belts properly blown up.

## Loom Weaves Curved Tire Fabric

**A**utomobile tire fabric woven and rubberized in the same operation and made in rounded form is the product of a new loom invented abroad and tested recently at the National Museum at Washington, D. C. Emanuel Ingham of London, England, is the inventor of the machine, which saves an important step in tire manufacturing.

The fabric base comes off the machine in curved form all ready to place on the tire rubber molding machine. Present machines weave a straight fabric, which has to be buckled before using. The new loom weaves a tire cord from one to three ply.



### Wind Is the Only Power Used by Newest Rotor Engine

**G**OING a step further than the rotor invented by Flettner, a new type of rotor has been devised by a Finnish inventor, S. J. Savonius. Flettner's rotor needs a small auxiliary motor to start rotation of the cylinders, but this one is said to need no auxiliary power whatever. According to the inventor, the wind is enough.

The cylinder is cut through the axis in two halves, which are drawn apart a distance about equal to the length of the radius. The rotor is fixed to a pier and is used to raise water from a lake to a garden 50 feet higher up.

A SERIES of landslides on the Matterhorn, one of the lofty peaks of Switzerland, necessitated the evacuation of whole villages. Sometimes soldiers had to force the inhabitants to flee to safety.

### Submarine Telephone Made on Heterodyne Principle

**O**FFICERS of submarines will be able to communicate with one another while far below the surface of the sea by using sound telegraphy. The Naval Research Laboratory has perfected the amazing undersea telephone which, it is explained, is based on the well known heterodyne receiving principle.

### New Fruit Discovered

**A** DELICIOUS fruit, hitherto unknown to the civilized world, has been discovered recently in the Tres Marias Islands, off the west coast of Mexico, according to reports made by the California-Mexican expedition that recently returned to the United States. Specimens of the fruit, which somewhat resembles the ordinary olive in size and color, were brought back by the expedition. Some of the seeds and young trees will be given to Luther Burbank.

### Sturdy Camp Seat Folds into a Compact Bundle

**"D**OES it take much space?" demands the motorist, when urged to add one more piece to his camping equipment. This durable chair, invented by J. H. Patterson, of Wichita, Kan., takes very little, collapsing into a compact bundle.



Stool open and folded

Well braced with steel rods, it is said to be strong enough so that even the 200-pounder may sit on it with assurance.



# New Records in the

## A Yardstick for the Soul—Latest



### What Makes the Wheels Go

Marvelous secrets of watchmaking are revealed to hundreds of visitors in the Smithsonian Institution at Washington, D. C., by means of this giant watch movement. Paul A. Garver, assistant curator, of the Division of Mechanical Technology, is shown comparing his watch with the monster time-piece.

Science moves ahead with wonderful swiftness. Discoveries follow one upon the other in such rapid succession that the busy man often finds it difficult to keep informed of them or to understand their full significance. It is to help you keep pace with the world's achievements that we present here, in concise form, some of the outstanding developments of the month.

### Measuring the Human Soul

OUT in the forest of Coye, in France, a distinguished mathematician worked in a lonely laboratory with delicate instruments, measuring, year after year, and calculating to the millionth part of a centimeter.

The other day he appeared at the Sorbonne and made an announcement that caused as tremendous a sensation in France as if a bomb had been exploded. For Prof. Charles Henry declared that the human soul—that mysterious thing that is not a thing, which man has accepted only through faith—now can be measured. It was the first time science ever had admitted tangible proof of the soul's existence.

Religion is right, declared Professor Henry. We never completely die. There is a certain electrical radiation or "biological vibration" that goes on and on. Set free by death, it seeks another envelope or body, because only by doing so can it establish its equilibrium.

Scientists today have ways of measuring the radiation of all substances. Yet after calculating the radiation in a body due to heat, that due to electromagnetic elements, and that due to the attraction of the earth, they find there still is some unknown force that is none of these. It is this elusive force that Professor Henry identifies as the soul.

### No Summer Next Year?

NO SUMMER in 1926. Shivering people, blasted crops. Such is the prediction of Herbert Janvrin Browne, meteorologist.

For three years Browne has been making this prophecy, which has been greeted generally with derision, but now he claims the support of eight leading scientists of Canada and Europe.

Changes in solar radiation and the moon's tidal influence, Browne explains, will bring up masses of cold, deep sea water on the continental shelves of the ocean. These will affect overlying winds and in turn result on the land in violent floods, extreme droughts, and frosts.

In 1816 the world had just such an experience. The idea that we are to have a repetition of the disaster comes from a study of the lunar cycles in conjunction with sun-spot periods.

### Tropical Valley in Far North

FOR 15 years rumors have come from the Canadian Northwest of a wonderful tropical valley in the midst of the icy plains. Recently two aviators, Colonel Williams and Mechanic Caldwell,

in a seaplane, penetrated the wilderness in search of gold and came out with confirmation of the story.

It is a valley 40 or 50 miles long, they say, with steam rising from innumerable hot springs. Luxuriant growth is everywhere—giant ferns, flowers, and lush grass. There are frogs and the aviators saw white moose roaming about. The aviators brought back a bottle of mineral water for analysis.

### Is America Drifting West?

GOOD-BYE, Europe. Hello, Japan! Are we drifting farther from Europe and approaching nearer to Asia each year, as many scientists have believed? Radio now is to be used to answer this fascinating question.

By means of radio time signals, a number of carefully selected spots around the earth, including Washington, D. C., and San Diego, Calif., in the United States, will test variations in longitude. These tests kept up for a few years, geodesists and astronomers believe, will prove or disprove the theory that the Atlantic Ocean was formed by the Americas breaking off from Europe and Africa.

Geologists point to recent investigations that indicate that beneath the top layer of rock crust, which is about 60 miles deep, there is a semi-molten layer of lava covering the earth's solid core. On this, it is believed, the outer surface is continually slipping. Another reason for thinking that the Americas once joined Europe is the remarkable way in which the ragged eastern coastline fits into that of the west coasts of Europe and Africa, like bits of a jigsaw puzzle.

A Dutch geodesist, Dr. Vening Meinesz, is planning to weigh the earth's crust under the Atlantic and Pacific oceans on a voyage of a Dutch submarine from Holland to Java. He already has examined the crust under the Indian Ocean. For this work he uses the most delicate apparatus for determining gravity, using it with the boat submerged about 50 feet to avoid disturbance by the waves.

### Finds Secret of Gold

A YOUNG man, Victor D. Avignon, superintendent of a plate company in Massachusetts, has rediscovered, it is claimed, an art lost in the fourteenth century when Benvenuto Cellini, famous Italian



### Experiments May Wipe Out Inkstains

What is the best way to remove ink stains from clothing? The U. S. Bureau of Standards is busy trying to answer this question for the National Association of Dyers and Cleaners by testing 150 varieties of inks on fabrics dyed with 1500 dyes. C. C. Hubbard, research chemist, is shown making a test.



# World's Progress

## Ideas and Useful Discoveries

goldsmith, died, taking the secret to the grave with him. The secret is how to make gold lighter and of greater volume so that it can be used to manufacture greater quantities of jewelry.

A saving of from 8 to 18 per cent in the weight of articles made from gold can now be made, it is said. At this rate the saving in a single year in the United States, estimated on an average total of \$60,000,000 worth of gold used by the arts, would be \$9,000,000. The new type of metal is reported to withstand stains and tarnish that prespiration heretofore has caused.

### Achievement in Aviation

A NEW type of dirigible to be built at cost for the United States Government by private interests is being considered at Washington. The new ship would be about half as large as the wrecked *Shenandoah* and made entirely of metal as light as fabric. It would have a speed of 70 miles an hour and a cruising radius of 2000 miles.

Our third airplane carrier, the U.S.S. *Lexington*, was launched recently on the Atlantic coast. It is a sister ship to the *Saratoga*, launched last spring, the two being the longest naval vessels in the world. The new ship has an immense sweep of flying decks.

Travelers from London to Paris now can dine in comfort as they cross the choppy English Channel, for the first aerial restaurant car in the world was installed recently in a Paris-London express plane. It has an electrically operated buffet, and meals are served to 20 passengers.

Not only can you eat, but you can sleep in the air. An Orient Air Express, designed to fly from Paris to Constantinople, will contain berths like those on trains and the engines will be specially silenced.

In Great Britain, where recent aircraft development has been wrapped in secrecy, two remarkable planes recently emerged from workshops. One is an airplane that can be converted into a sailing vessel, similar to the one described in the August issue of *POPULAR SCIENCE MONTHLY*.

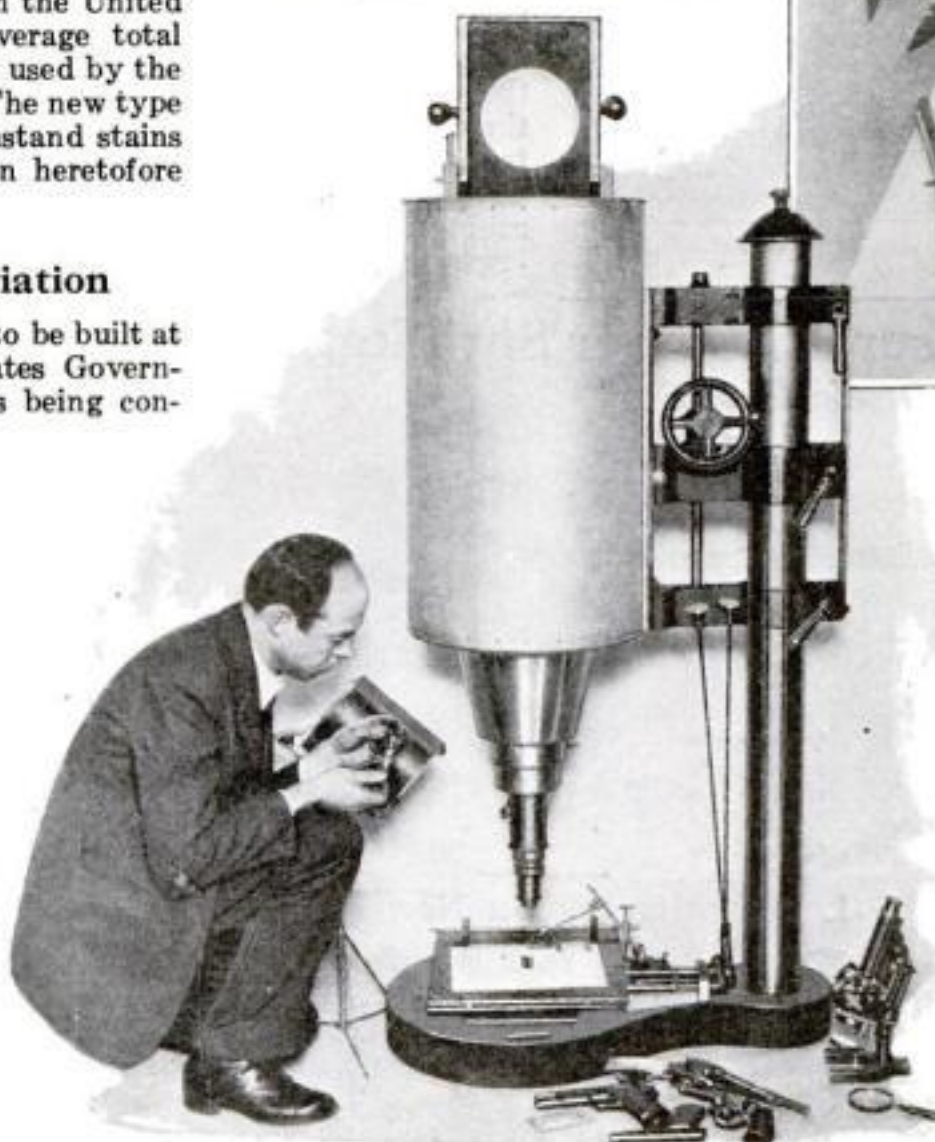
The other is a midget plane that has a speed estimated at 200 miles an hour. It is the smallest machine for its horsepower ever built, and could rest comfortably on the tail of a giant bomber.

### Freight Tubes for London

LONDON is suffering from extreme traffic congestion on its streets, even more than New York, since it has fewer motor-trucks and more horses. It, too, is considering building great underground

### An Eight-Foot Microscope

Under the powerful lens of the world's largest microscope (below) a human hair looks like a weather-beaten telegraph pole. The huge instrument, invented by Luke S. May, Seattle criminologist, stands eight feet high and weighs a quarter of a ton. Its range of magnification is from two to 5000



freight tubes. These would link railroad yards and docks with central depots for receiving and handling freight, and also would form a network of lines under the central regions of London.

Such a system, it is estimated, would cost \$160,000,000, vastly less than a similar undertaking would cost in New York City, for London is built on clay through which tunnels can be driven with comparative ease, while New York stands upon rock.

### Saving the Hillside

AMERICAN tourists in Italy have marveled at how the gardeners there terrace the hillside, making use of every square inch of ground for olive orchards or vineyards.

"We might do the same thing to our hills at home," they have exclaimed; "but think of the cost of the labor!"

Modern machinery, however, at last has solved this difficulty, and the same economical methods used in Europe now are being adopted to keep the ground on Appalachian slopes from washing away, and causing terrific losses to farmers.

Not long ago a retired engineer,



### Wiping Out the Tomato Pests

In fighting plant diseases and pests that attack their vegetation, British farmers now are being aided by an experimental and research station recently opened by the Ministry of Agriculture at Cheshunt, Herts. The photograph shows an experimenter inoculating a young tomato plant with disease germs by pricking a leaf

Lawrence Lee, of Leesburg, Va., thought of a way to use tractors and a specially designed scraper, to cut hillsides into sharp steps that would hold the rain. Even in the heaviest thunderstorms, hardly a drop of water runs off the 60 acres that Lee has terraced and planted as an orchard.

Should the Appalachian region as a whole adopt the tractor-built terrace, it is estimated that a new dividend-paying country the size of France would be added to the United States, to say nothing of some delightful scenery.

### Quarts of Buried Pearls

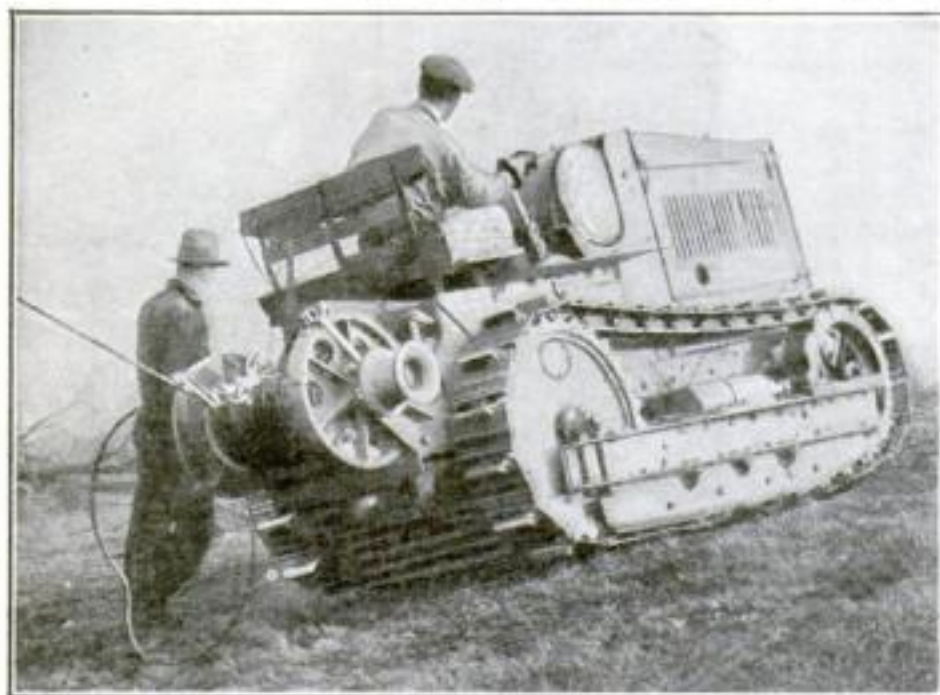
WHY travel to far Egypt for thrills in ancient tombs when archeologists can find a burial-place of the "Princes of the Pearls" right here at home in Ohio? When the skeletons of four supposed princes were lifted from their tombs in an Indian mound near Bainbridge, it was found that they had lain on a carpet of pearls. Quarts of the gems were swept up by the amazed explorers.

The Indians who built the Ohio mounds and accumulated the jewels were as fastidious as modern jewelers about their quality, according to Dr. Walter Hough of the U. S. National Museum. They used only perfectly shaped pearls, rejecting even baroques.

The great mound in which the pearls were found is surrounded by a number of smaller mounds, none of which has been opened. The approach of winter halted excavations with only a fourth of the great mound explored. Until spring the mounds will retain the secrets they have held for centuries.



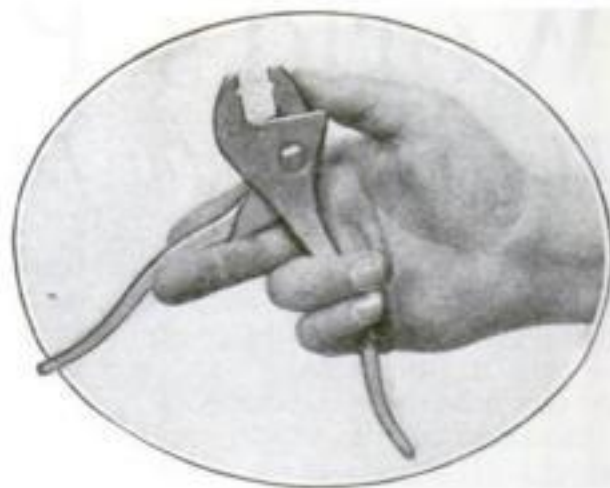
## This Tractor Operates Winch Attachment



Operating tractor winch to string wires for a power line

**I**N MANY kinds of engineering work, such as raising poles, lowering sewer pipes, or releasing mired trucks, this tractor winch attachment has been found very useful.

The winch has a drum nine inches in diameter and 22 inches long, and it holds 800 feet of one-half-inch cable. The drum is driven by the tractor engine through the regular transmission and has three speeds for raising and one for lowering materials.



### Handy Plier-Wrench Grips Objects Large or Small

**A** COMBINATION plier and wrench is a new tool handy in the repair shop or about the house. It is said to grip small objects such as a pin head as firmly as it does nuts  $1\frac{1}{2}$  inches square. To change adjustments, the lever is opened to its limit and the jaw moved with the thumb.

When the tool is being used as a wrench, notches in the jaw seize the corners of a nut firmly.

### New Paint Changes Color

**A** SWEDISH scientist has invented a paint that changes color with advancing temperature—a discovery that may prove useful for painting machinery as a warning to the operators of overheating.

### Light Steel Harrow Designed for Double Purpose

**A** HARROW that can be used both for making the seed bed before planting, and for cultivation of the plants after they are grown, is the invention of L. C. Holloman, of Memphis, Tenn.

It is made of steel and weighs only 70 pounds, so that a small mule or horse can pull it over the ground with ease. It is hinged in the center, so that it will straddle a three- or  $3\frac{1}{2}$ -foot seed row before planting.

The teeth of the harrow are only four inches long, being made this length to avoid tearing or injuring the roots or the stems of small plants.

## Precision Rule Measures Lumber Shrinkage

**M**EASUREMENTS of shrinkage in drying lumber are not easy to make, and yet much depends on the calculations made from test pieces. This new rule makes possible quick and accurate measurements of the percentage of shrinkage. It is 12 inches long and is graduated into fiftieths and hundredths of an inch.



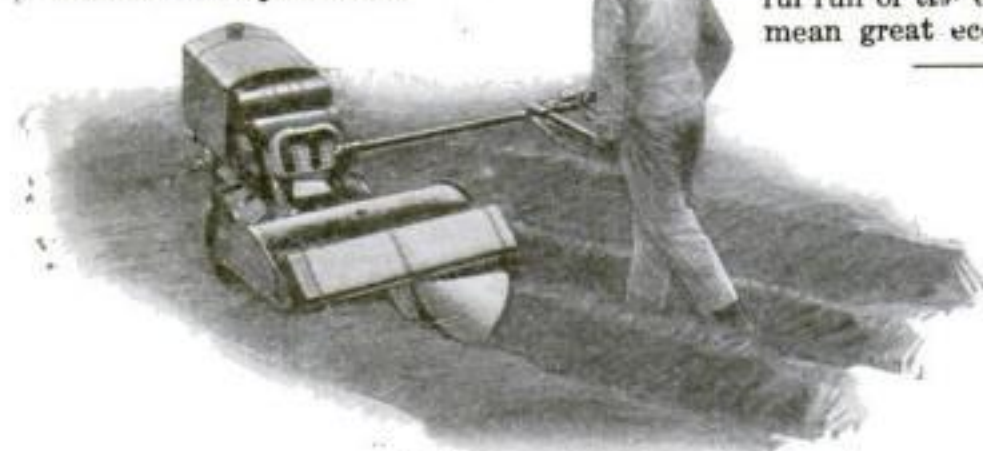
The new rule is graduated to hundredths of an inch

### Tiny Battery Runs Car 10 Days

**A** VEST-POCKET battery containing enough energy to drive the most powerful motor-car for 10 days is an invention claimed by A. F. Joffe of the Academy of Science in Leningrad, Russia.

Experimenting in his own laboratory, he says that he succeeded in obtaining this tremendous concentration of electrical energy in a very small object—a discovery that, if proved authentic, may have a revolutionary effect on industry.

### Ingenious Rotary Plow Is Driven by Motor



**A** ROTARY plow, called a "rototiller," for either deep or surface cultivation, recently has been introduced in England to take the place of the usual type of plow pulled through the ground. Its revolving blades, driven by motor, bite into the soil without throwing it to one side or packing it.

It can cultivate between narrow rows and turn in its own length. The machine is useful, too, for mixing manure with the soil or destroying weeds.

When a ridger is attached behind the tiller, both tilling and ridging may be done at the same time. Or a special truck can be connected with the machine, to be used for hauling.

### Locomotive Sets a New Record

**E**NGINE 3334 recently puffed triumphantly into Harmon, N. Y., having completed a 2000-mile round trip from New York to Chicago in 72 hours. This without any grooming except the ordinary roundhouse oiling and cleaning at Chicago.

Heretofore it has taken seven locomotives and seven crews, used in relays, to take the Limited to Chicago from New York. The successful run of the new locomotive may mean great economy in the future.



Harrow is useful for making seed beds and for cultivating



## Trees Uprooted by Mechanical Lumberjacks

THE back-breaking efforts of early pioneers in clearing land scarcely will be appreciated in future years. A recent demonstration showed that it is now possible with machinery to fell a large tree in nine minutes. Not only is the tree down, but it is pulled up by the roots also, so that these are out of the way.

A cable is put around the tree trunk at its base and a small monkey winch used to pull the tree over. A power saw driven by a small gas engine cuts the trunk into convenient lengths.



These photographs show a public demonstration, in London, England, of the felling and cutting of trees by machinery. A winch pulls the trees up by the roots as shown above, and a small power saw at left cuts through the trunk in four minutes.

### V-Blocks and Clamp an Aid to the Toolmaker

THIS pair of V-blocks and clamp are designed especially for use of the toolmaker and general machinist. Many operations on round bars are facilitated greatly. The bar can be held firmly while center holes are being punched or the bar is being drilled, ground, or milled. The blocks are two inches long by 1½ inches square and the clamp is large enough to hold bars up to 1½ inches in diameter.

### Envelopes Now Moistened and Sealed Automatically

A NEAT little envelope sealer that may be screwed to the office desk, moistens and seals with a single motion.



Moistened and sealed with a single motion

When an envelope is passed through the device, the flap is lifted automatically and moistened, and the envelope sealed. When not in use, the sealer swings out of the way.

Water in a reservoir moistens a pad over which the flap passes. The machine will handle any size of commercial envelope.

### Burbank Gardens to Be Sold

THE world-famed gardens near Santa Rosa, Calif., where Luther Burbank has carried on his experiments for the last 50 years, are to pass into the hands of university scientists for maintenance and perpetuation. Private capital has offered as high as a quarter of a million dollars for the gardens, but indications are that Stanford University will get them. The plant wizard has offered them to the university at half their valuation.

### Power Mower Has Differential

RIDING around on a lawnmower is a man's dream of luxury, as he laboriously pushes his hand power machine through the tough grass. Here is one of the latest models of motor-driven lawnmowers that will do the work almost while you are thinking about it.

The machine has a water-cooled engine, with direct drive to the cutting blades. The land roller is built in three sections, serrated so that the machine will not skid. The middle section takes the drive, while the two outer sections provide a differential action while negotiating corners. All three can be locked by releasing a spring plunger.



The power mower is so simple in operation that a woman can handle it easily

### How Much Do YOU Know about Science?

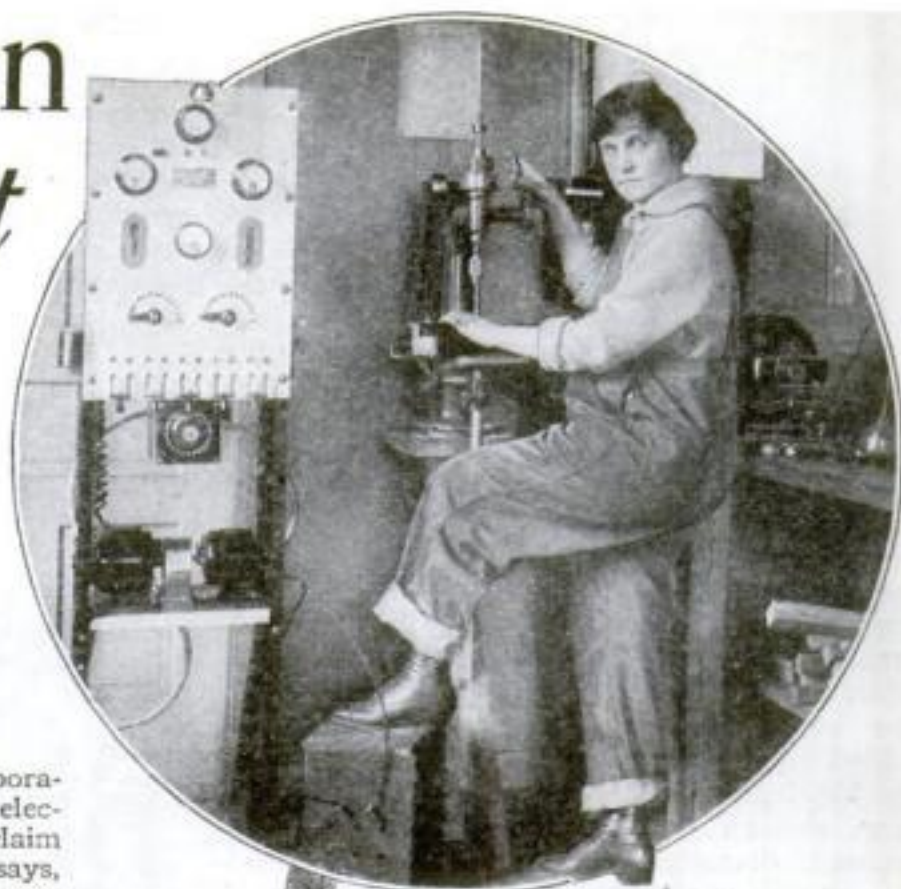
THESE questions are chosen from the many that come to POPULAR SCIENCE MONTHLY every day. Look them over and see how many you can answer. Although the questions concern things that we all frequently encounter, it is surprising how many new and interesting facts they reveal about the world in which we live.

After you have finished, turn to page 166 and see how many of the 12 questions you were able to answer correctly.

1. Why is a child's voice shrill?
2. In a race down hill between two sleds, will the heavier sled go faster or slower than the lighter one?
3. Why does the water in the hot-water pipes of a house freeze more readily than that in the cold-water pipes?
4. What are the rings around Saturn made of?
5. Why does a wood fire snap and crackle?
6. What causes volcanoes?
7. How does the electric needle remove hair?
8. Why does the cut surface of an apple turn brown?
9. Do animals have memory?
10. How is a vacuum tube used as a detector?
11. Why do pine trees stay green all winter?
12. Which are more excitable, blue-eyed people or black-eyed ones?



# Unusual Women Who Work at Men's Jobs



## Radio Wizard

Mary Texan Loomis, a radio expert of London, England, is a master workman at the finest mechanical jobs. This picture shows her in her laboratory, operating an electric drill. Men can claim no monopoly, she says, when it comes to mastering mysteries of radio

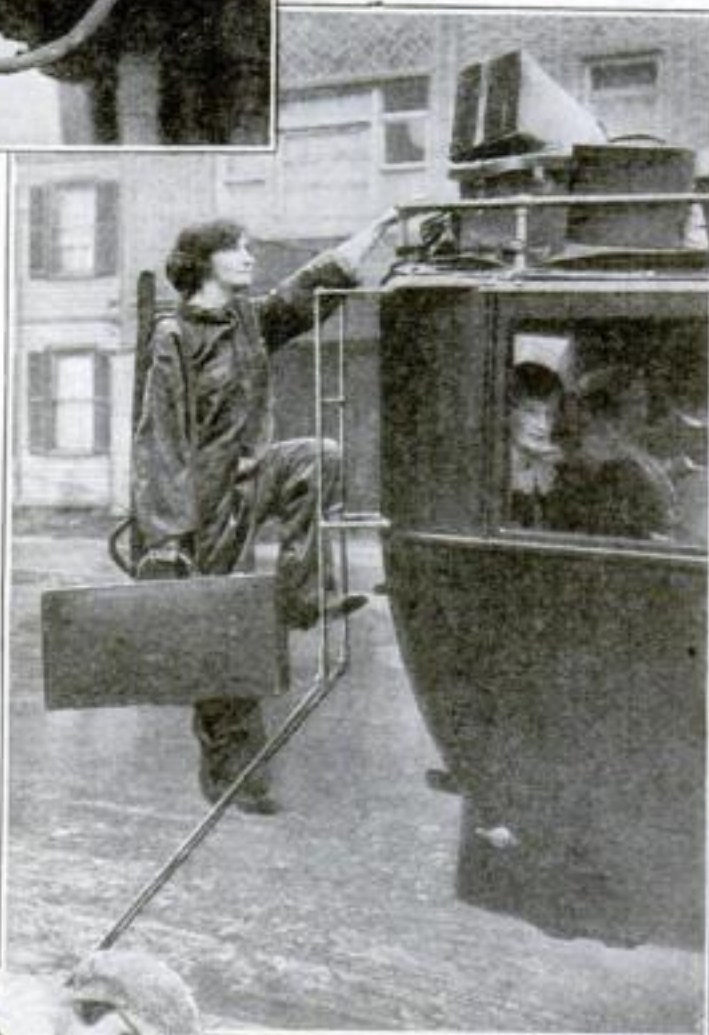


## Expert Welder

Mrs. Katherine Nelson (above) of Jersey City, N. J., earns as high as \$30 a day as an expert welder. Formerly she worked in railroad shops, but now she is in business under her own shingle

## Your Bag, Sir?

Miss May Bailey (right), of Tarrytown, N. Y., holds a real man's job, for she handles all the baggage on a motor-bus that makes regular trips from New York to Montreal, Can.



## Going Up!

Painting a 200 foot smokestack is all in the day's work for Mrs. T. V. Wesella, of Oakland, Calif.



## At the Forge

At 54, Mrs. Sophie Penkinson (right) claims to be the only woman blacksmith. In her shop on Pike Street, New York, she does all the heavy work

## A Bricklayer

Bricklaying is fun, says Mrs. Florence Thompson of New York, probably the only woman in the world who follows this ancient trade



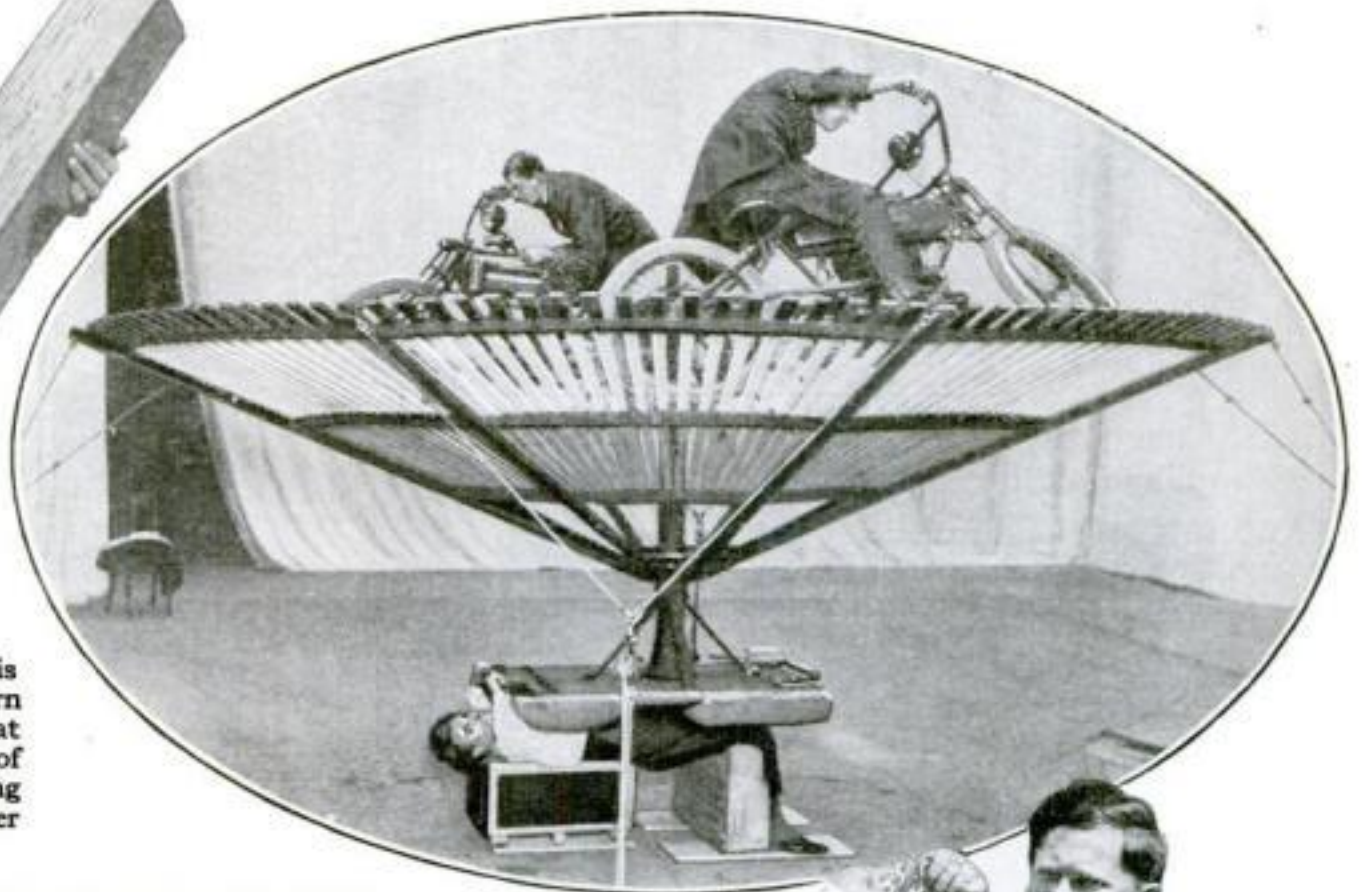


## He Drives Nails By Hand



No need of a hammer when A. S. Zass is around. He is a Cossack, from southern Russia, and so great is his strength that he can drive a nail into a thick beam of wood with one hand while supporting the great heavy beam with the other

# Men Whose Strength Rivals Samson's

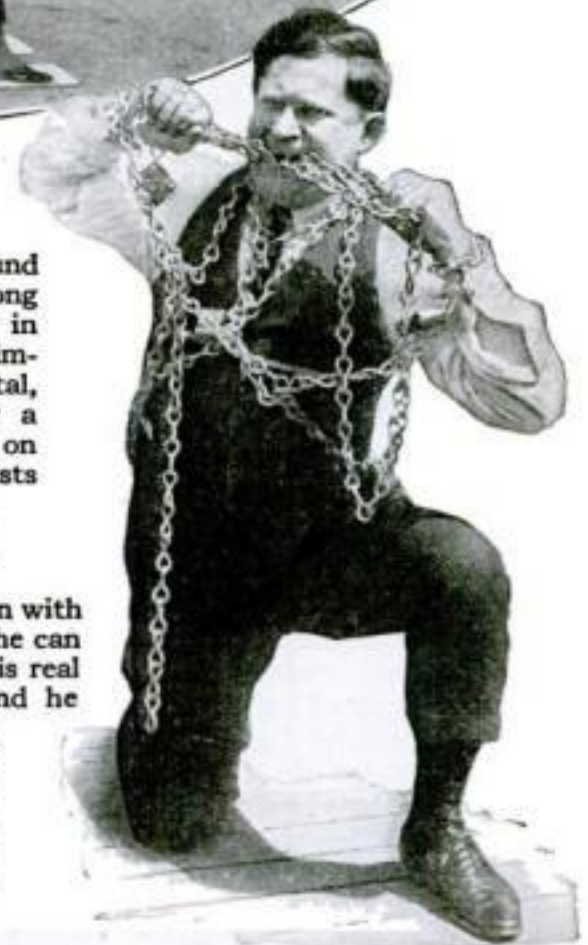


## Human Base for a Motordrome

A spectacular feat of Sigmund Brietbart, famous strong man, who died recently in Germany, was to make himself into a human pedestal, supporting on his body a miniature motordrome on which two motorcyclists whirled at top speed

## Teeth of Iron

He calls himself the "man with the iron teeth" because he can bite through chains. His real name is Ben Darwin and he comes from Texas. Recently he helped a ship's engineer out of a difficulty by chewing through a chain that had become tangled

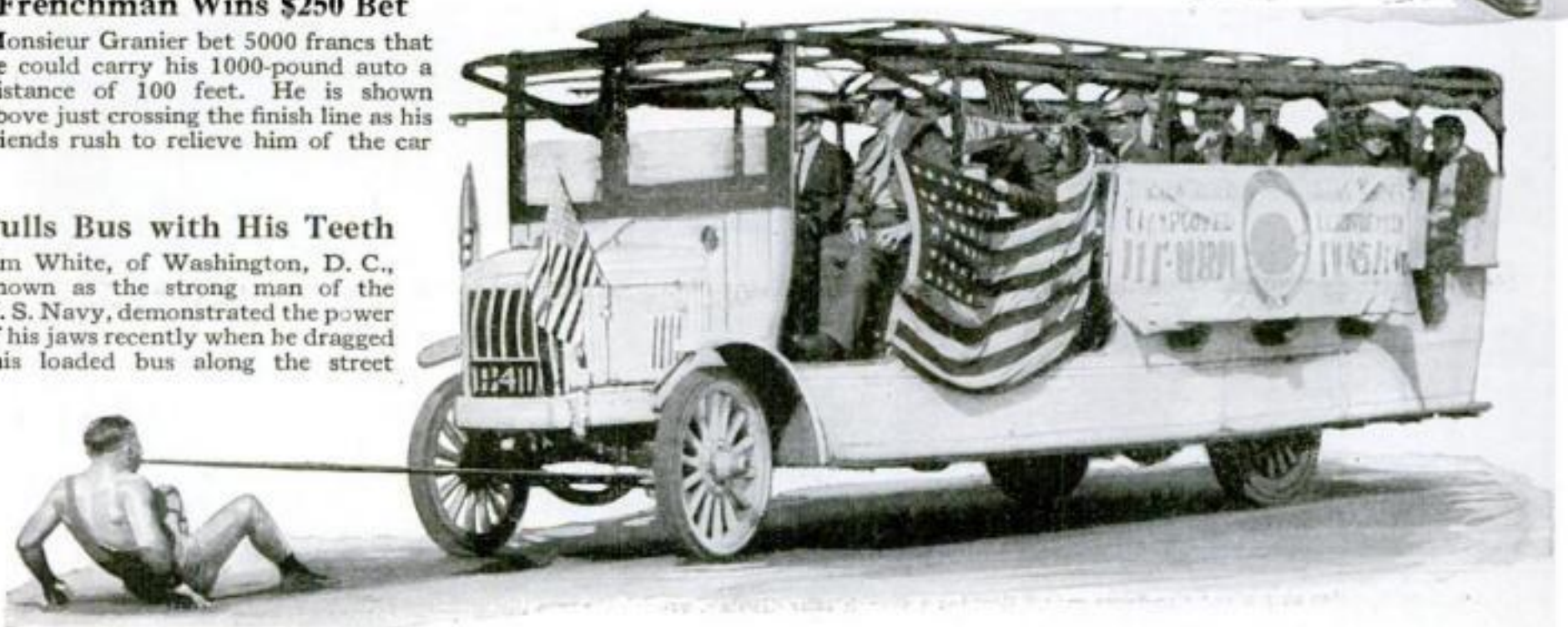


## Frenchman Wins \$250 Bet

Monsieur Granier bet 5000 francs that he could carry his 1000-pound auto a distance of 100 feet. He is shown above just crossing the finish line as his friends rush to relieve him of the car

## Pulls Bus with His Teeth

Jim White, of Washington, D. C., known as the strong man of the U. S. Navy, demonstrated the power of his jaws recently when he dragged this loaded bus along the street







### U. S. Coastguard now Uses Disappearing Searchlights

**S**EARCHLIGHT towers that rise and disappear, like a disappearing gun, have become part of the seacoast service equipment. They vary in height from 45 feet to 100 feet. In less than a minute one man can raise or lower one of the smaller towers that are designed to carry 60-inch searchlights. When not in use, the searchlight is protected in a small steel house, mounted on wheels, where access to it is easy for needed repairs.

The light rests on a swinging platform at the top of a steel frame. There is room for several men to work around the light, which has an intensity of about four billion candlepower and which casts its beam for many miles.

### Fleets' Lights Transform Harbor into Fairyland

**I**N A magnificent night array the ships of the U. S. Fleet are shown here in Los Angeles Harbor. Each of the giant fighters was illuminated with thousands of electric-light bulbs, while powerful beams of searchlights penetrated the black heavens, crossing one another, making a canopy of light.

The reflection of lights on the water added to this, made the scene one of remarkable beauty.



Men raise themselves up huge stack by two rope loops

### Patience and Patriotism Composed Unique American Flag

**A** 'STAR-SPANGLED banner that will wave long is made of three million crocheted stitches—a symbol of patience as well as of patriotism. Night after night for the past six years, Mrs. Josephine Foster, of New York, has worked on the flag, which measures seven by 11 feet. The red and white stripes are crocheted in filet design with a conventional flower every two or three inches. The blue field is worked in a more solid stitch.

In the illustration below, her small son is helping Mrs. Foster display her unique handiwork. It takes a stiff breeze to wave the flag on account of its weight.



The flag that took six years to make

### Steeplejacks Win!

**W**HEN this 175-foot smokestack was built in Cleveland, Ohio, it had no ladder. When new paint was needed, two steeplejacks made the ascent by rope loops. Pushing the highest loop upward with long poles, they raised themselves by the lowest loop.

### They Drink with Sticks

**A**N ANCESTOR to the straw through which we sip our sodas has been discovered in East Africa. Yak trees there have cavities in their trunks in which rain water collects.

The natives frequently carry "drinking sticks" two feet long and half an inch in diameter that they use to sip the water out of the trees.

### Bald Mice Produced

**H**AIRLESS mice, suitable prey for the Mexican hairless dogs, have been produced in Dr. Francis B. Sumner's "mouse house" in La Jolla, Calif., where he breeds mice for experimental purposes. Whiskers and long eyebrows bristles remain on the queer animals, but the rest of their skin is bald.



What Los Angeles saw when the fleets met. Besides a searchlight display, every ship was illuminated with thousands of lights





## New York Village Disappears beneath the Waters of an Artificial Lake

THE citizens of Gilboa, N. Y., a prosperous little farming community in the Catskill Mountains, simply could not realize that their homes soon were to be at the bottom of a huge lake. They were

told eight years ago that in the year 1925 they would have to move, for waters would come flooding in and their village streets be seen no more.

The site was to be used for a huge

artificial lake 150 feet deep, five miles long, and holding 22,000,000 gallons of water for the water supply of New York City.

The waters of Schoharie Creek were to be blocked by an enormous dam to supply the reservoir.

This fall the dam was completed and the last of the 200 residents was forced to leave. The lake now is forming. The photograph shows trees being felled in the main street of the village and in the background can be seen the dam under construction.

AIRPLANES from Mitchel Field, N. Y. City, have flown a distance nearly equivalent to four round trips to the moon in the last 25 months—1,827,000 miles.

### Compressed-Air Engine Built by Aged Inventor

LOUIS C. KISER, a 77-year-old inventor of Decatur, Ill., has been working for years on a system for driving an automobile by means of compressed air. In adapting his

77-year-old inventor of compressed air automobile engine



compressed-air system to an ordinary car, Kiser removes the entire gasoline line, the cylinder head, water-cooling system, and self starter. A special cylinder head is substituted and a compressed-air tank added in place of the gasoline tank.

The inventor claims that the only fuel expense will be the cost of the necessary lubricating oil, but it is not quite clear as to where the compressed air is to come from, since the only way in which compressed air can be obtained is to get power from somewhere to compress it.

### Siam Shows Us a New Game

TAKRAW, as the Siamese call their curious game of football, is making its first appearance in America. The Prince Bejrapur-na championship team is touring the country demonstrating that to play football with hollow wicker balls requires more agility and speed than with the heavy pigskin.

The star player of the Siamese team, Bayin, was photographed in the University of Pennsylvania's gymnasium. He is demonstrating two of the more difficult shots—the back kick and juggling.

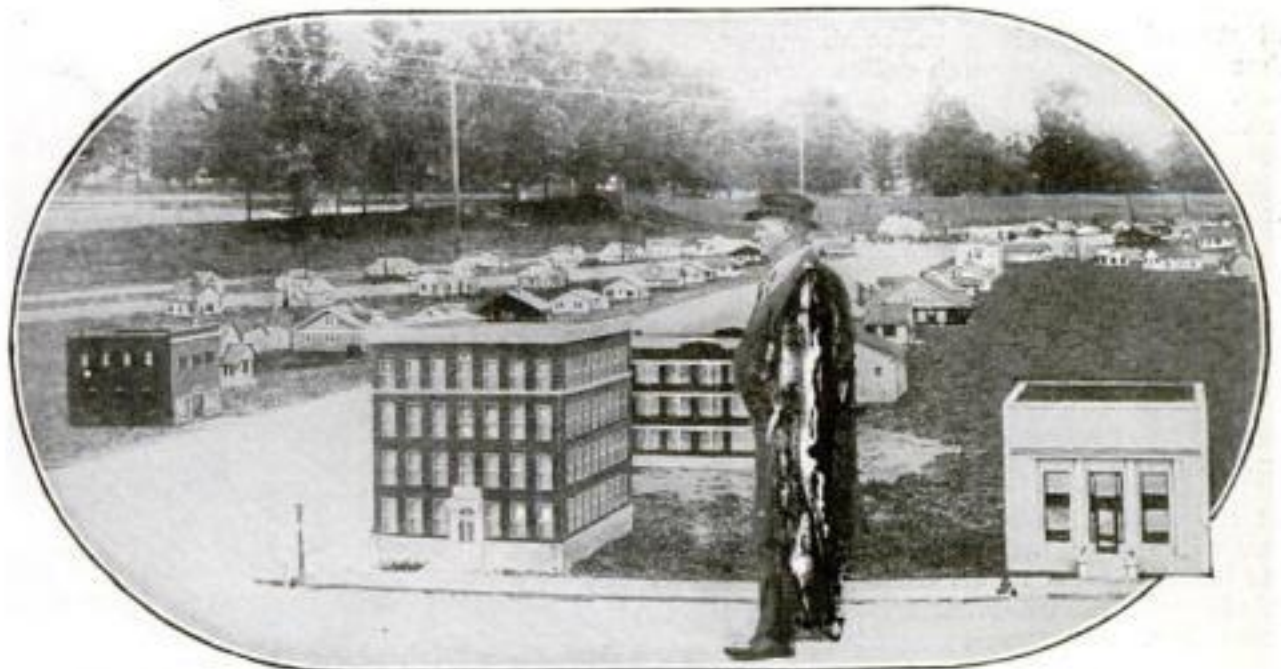


A player juggling five balls

### School Children Construct a Miniature Town

FROM the dizzy heights of a stepladder, a tiny town constructed by school children of Springfield, Ill., recently, looks like a real city viewed from an airplane. The miniature town was constructed under the direction of William E. Johnson, who is pictured surveying the Lilliputian metropolis.

The corner building in the foreground is the town's Y. M. C. A., while the one to the right is a bank. There are apartment houses, garages, stores, and cottages, just as in a real city. Constructed on a scale of one inch to one foot, the model town occupies a space 1000 feet long and 250 feet wide.



Model town, built by Springfield, Ill., children, occupies 250,000 square feet of space



# New Ideas to Make

## How Inventors Are Supplying the



### Stropper Oiled on the Hand

It is claimed that any safety-razor blade can be sharpened in this 1½-ounce stropper. Oil is obtained by rolling it over the hand, five strokes for each side of the razor blade



### No More Leaky Pies

Many a cook has been in despair because the juice of a fruit pie has oozed out into the oven. A new pie-sealing paper tape prevents this. It is an inch wide, gummed at one end in regulation lengths



### Safety Ashtray

A lighted cigar or cigarette is placed on heat-conducting wire of ashtray. It smolders for a while, but goes out before lighted end reaches wire



### Electric Heater for Fireplace

Here is an ingenious and useful new type of electric stove that fits attractively into the fireplace and supplies abundant heat to warm a chilly room. Merely plugging in a cord on a wall socket sets it to radiating comfort and cheer on winter evenings in any room in the house



### It Saves Coffee

Illustrated above is a coffee dispenser that delivers just enough coffee for one cup. Ground coffee is put in the glass container and by pulling the slide at the bottom, the exact amount is released. Accurate measuring and consequent economy in this way are made possible

### Chain Fastens Mop

The special chain feature of the mop handle shown at the right enables the operator to hook the mop in position and lock it securely. By this means, one handle will do duty for two or three mops



### Every Man His Own Cobbler

At right: No nails are needed in this new method of mending shoes. First, the leather is cut to fit, then the upper sole is covered with waterproof glue that comes in a tube, the new sole is applied, and the two are clamped together with strong wire clamps until the glue is dry



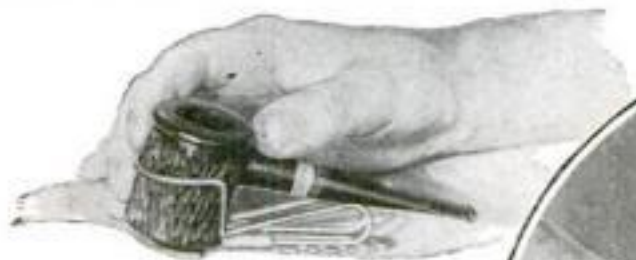
### New Broom Is Adjustable

Because the handle is swiveled to the brush, the broom can be used in the ordinary way, or as a side sweeper, or in a flat position, to go under low pieces of furniture. The handle is detachable and, like the mop shown above, may be used with various types of brushes, say, a wall brush or an oiling brush, if they are fitted with swivel lock



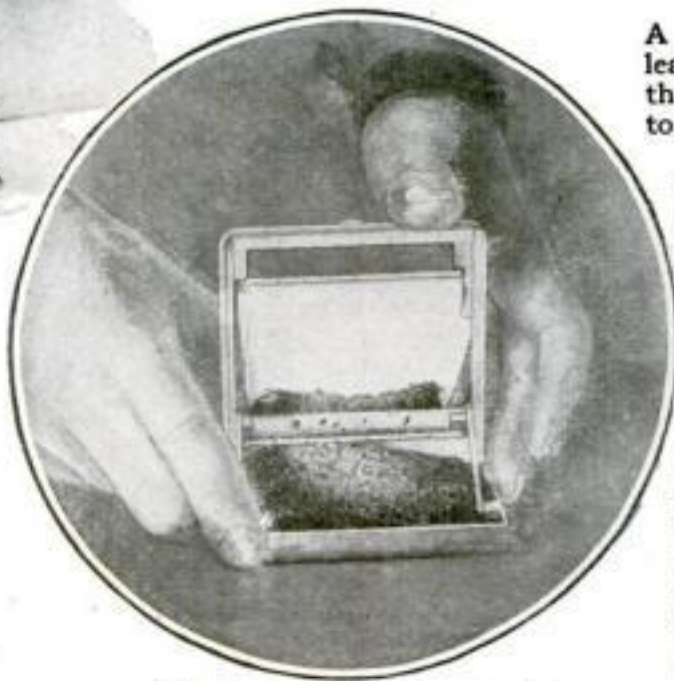
# Your Home Attractive

## Household with Comforts and Conveniences



### Handy Pipe Stand

If placed on this stand, a pipe will not tip over and scatter its contents. To make it even more acceptable, it is combined with a reamer that cleans out caked tobacco



### This Case Rolls Its Own

Carrying enough tobacco for 20 cigarettes, this new case also rolls them. Paper and tobacco are placed in a trough, the case is closed, and a rolled cigarette appears

### A Novel Hairbrush

A pocket hairbrush made of leather and curved wire bristles that also serve as a comb, is said to keep the hair in good order



### Simple Meat Grill

Providing that the hand grill at the left is well heated, it can be used on an electric, gas, or oil stove. It catches all fat and gravy in a deep groove that surrounds the grill



### Magic Wall Table

When not in use, this handy little table folds flat against the wall. It opens from six to 48 inches—that is, it can be drawn out to twice the size shown above. The surface is just as smooth when extended as when closed. The table is made in various finishes—white enamel, unfinished, painted, or stained, to suit whichever room table is used in



### Screen Rolls like Shade

Screens that roll up like a window-shade are a boon when windows are to be cleaned, and forever settle the question of screening casement windows. They are fitted to a strong steel frame that usually is painted the color of the wood trim. Furthermore, they are rust-proof



### No Dust Gets on It

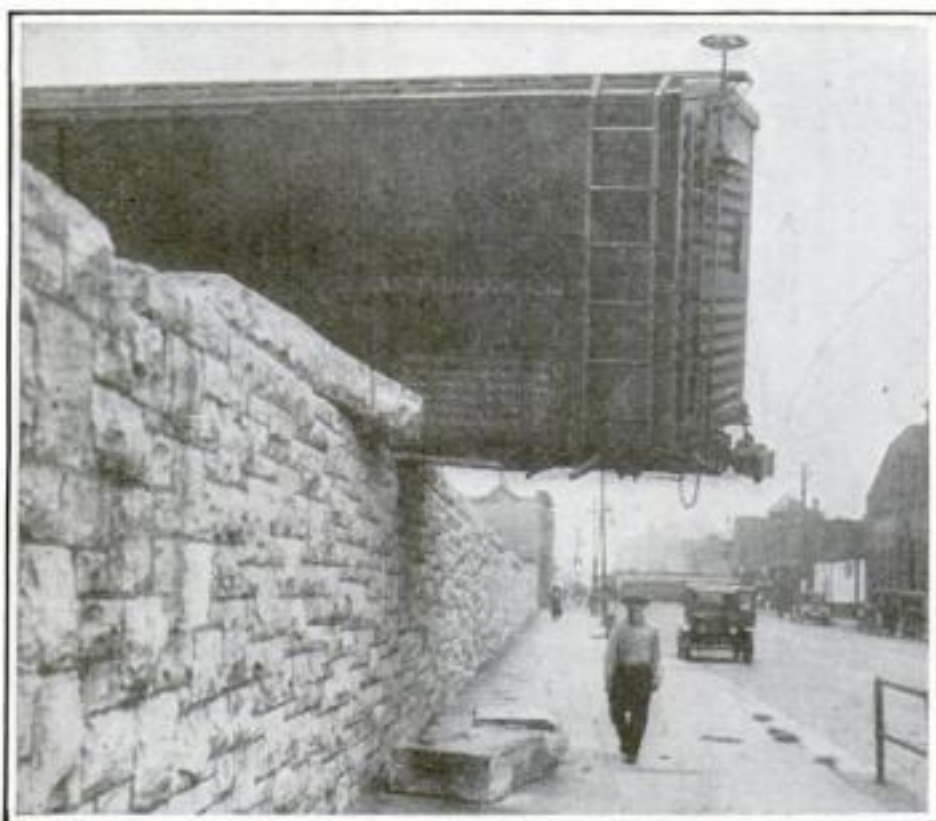
Because it solves the problem of airing a toothbrush while keeping it free from dust, the handy holder at left should recommend itself to women whose aim is a hygienic home

### Truck for Ash Can

There are many uses for this two-wheeled, rubber-tired truck. Its most unusual feature is a lever, which by simple adjustment aids in lifting a loaded car up steps. The truck also can be used without the elevating lever if running on level ground

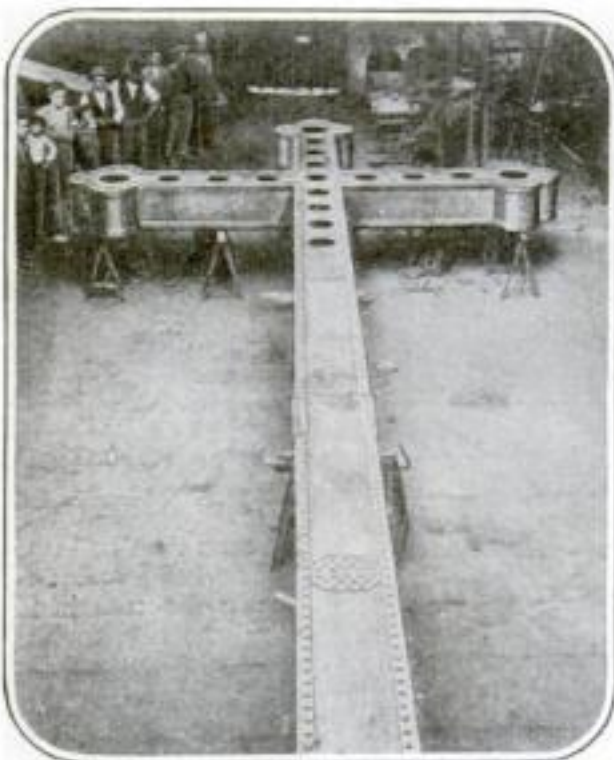


## Runaway Freight Car Leaps a Stone Wall



The car balanced on a wall and hanging above the street

## Bronze Cross 65 Feet Long Built in Sections



A GREAT bronze cross 65 feet long and weighing many tons was completed recently in Rome, Italy, for the Sanctuary of the Holy Virgin of Pompeii. It was constructed in sections that were riveted together.

Italians in all parts of the world contributed to a fund that paid for this cross, which is said to be the largest that ever has been made of this material.

## Frigid Climate on Venus

VENUS belies its name and has a frigid countenance. Its inhabitants, providing it has any, must wear overcoats or furry skins. Observation of the planet through the 100-inch telescope at Mount Wilson Observatory has disclosed that the average day temperature of Venus is just about the freezing point.

The night temperature is the same just before sunrise or soon after sunset. Both temperature and spectroscopic examinations favor the belief that Venus's day is a year long, since the planet always keeps the same side to the sun.

Who discovered America? Not Columbus, not the Norsemen, but a Chinaman, according to Scie Tou Fa, director of the Chinese Information Service in Paris. Five Buddhist priests, in 458 A. D., discovered an immense island east of China that they called "Fou Chang," he declares. Descriptions they left of it convince Chinese scholars today that it was America.

When the first Spanish explorers landed, Scie says, they were impressed by the similarity of architecture there with that of the Orient.

THE wall stopped it. After jumping the tracks, a runaway freight car recently slid halfway over a stone wall in Chicago and suspended itself with one end above a sidewalk until the wrecking crew arrived. This unusual photograph was taken a few minutes after the strange accident had happened.

In its headlong course, the car knocked two rocks off the wall and loosened a few more, but did no other damage.



## One-Man Band Plays Seven Instruments at Once

WHEN Roy R. Harper, of York, S. C., strikes up a tune, he is a whole band by himself. He plays a harmonica, mandolin, guitar, drum, triangle, and bell all at one time and by strapping a tambourine on his right hand, the number of instruments this versatile man plays is increased to seven.

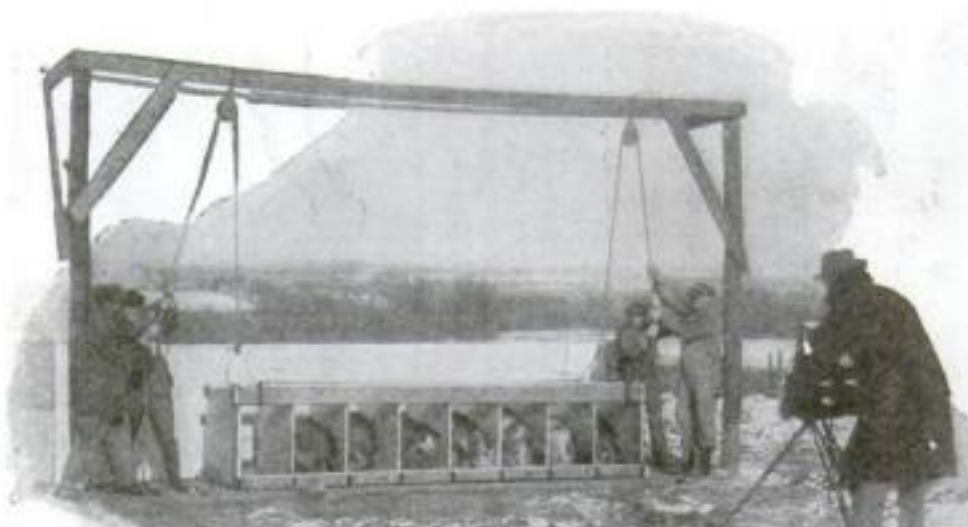
The surprising thing is that a man can make so many different motions simultaneously.

## Found at Last—A Way to Photograph Pigs

PHOTOGRAPHING a pig is a hard job, as any one will testify who has tried it. Just when the animals are posed properly and the photographer is ready to snap the camera, around they

whirl and the tail is in the picture where the snout is supposed to be.

The Ohio State Agricultural Experiment Station has found a way to outwit them. The pigs are driven into a frame which furnishes eight stalls in a row, and they face the camera through a wire screen. When the camera is focused properly, the frame is hoisted by means of overhead pulleys, and a successful exposure made as soon as the frame is out of the way.



The upper picture shows the pigs housed in stalls facing the camera through a wire screen while the photographer gets his focus. When all is ready, the stalls are hoisted by means of pulleys (right) and the picture then is taken







### Patent-Leather Eyebrows Can Be Polished with Brush

**J**UST stick 'em on, and you have a brand new pair of eyebrows. Blonde one day, brunette the next—anything you like. You can change them to match your wig, if you wear wigs.

This startling fad of wearing patent-leather eyebrows was introduced recently to Hollywood, Calif. An advantage pointed out is that they may be polished with a shoe-brush.

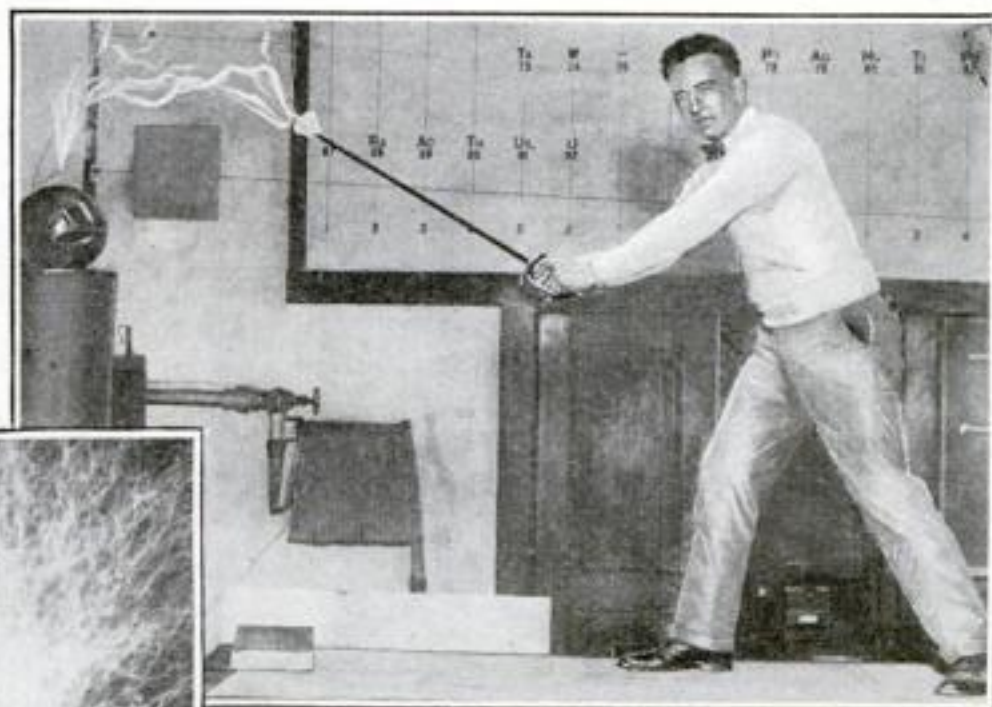
### Cottonseed for Beefsteak

**A**RTIFICIAL beefsteak, how does that appeal to you? Anyway, it's coming, according to Dr. Davis Wesson, of New York, formerly president of the American Institute of Chemical Engineers. It will be made from cottonseed.

Doctor Wesson says recent investigations by the United States Department of Agriculture showed that protein of cottonseed closely resembles that of meat, and declares it is only a matter of time before chemists will discover how to make a meat substitute from the seed.

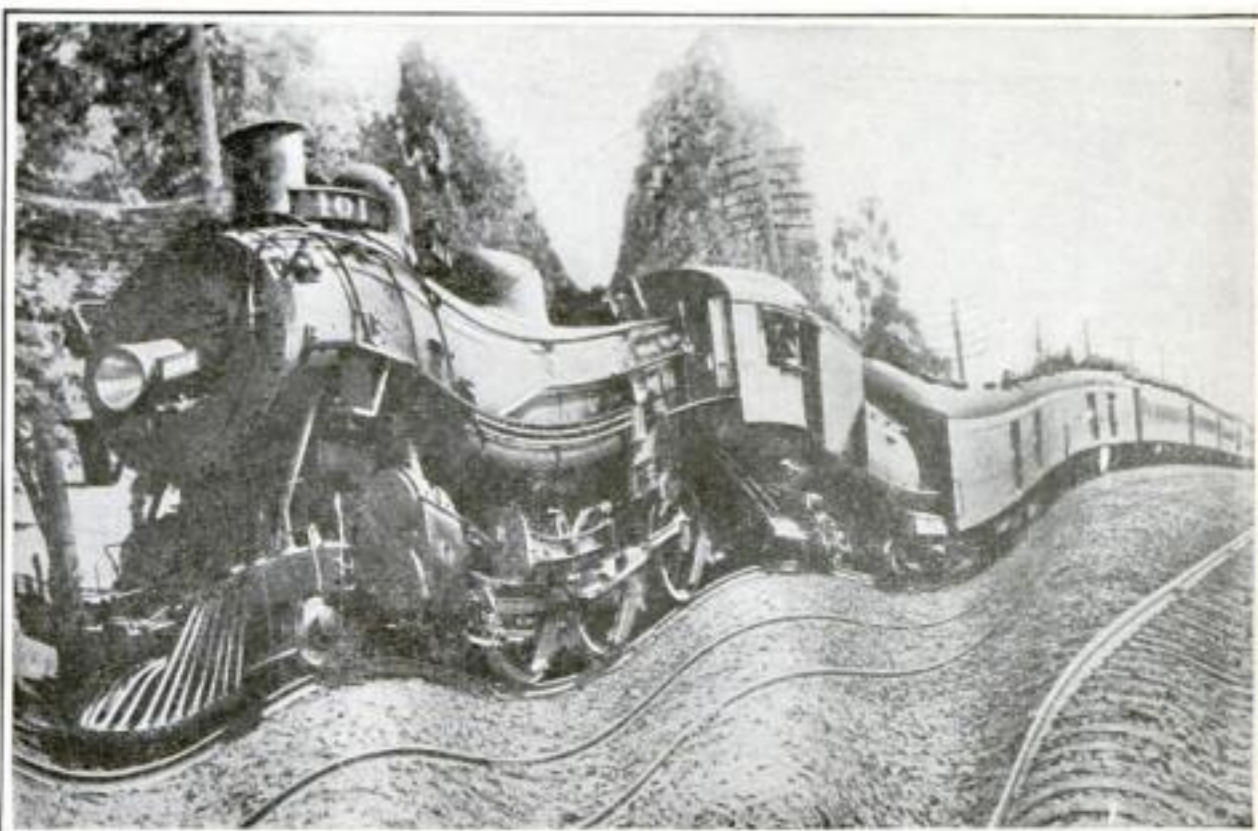
## A Million-Volt Flash of Man-Made Lightning

Right: Ray M. Palmer, of the University of California, receiving man-made lightning flash of 1,000,000 volts through a sword. Below: The charged ball that produced the flash and created a four-foot corona.



**W**HEN, a few weeks ago, Ray M. Palmer, a student in the electrical laboratory of the University of California, let 1,000,000 volts of electricity pass through his body, the spectators were far more disturbed than he was, although he said afterward that the stroke of man-made lightning made him feel quite "ticklish." He received the lightning flash through a sword from a charged ball that sent forth a brilliant corona, more than four feet deep.

## Trick Photography Makes a Train Shimmy



**D**ON'T believe all that you see. Here is a train apparently shimmying into San Francisco. But although it carried Gilda Gray, the queen of shimmy dancers, the passengers will tell you that it proceeded along its way in an orderly, everyday fashion.

Its seeming wiggle and the tracks undulating in the most approved cabaret fashion are a curious product of trick photography.

### Househunting by Airplane

**A** BUSY London pilot recently went househunting with his wife in a two-seater baby plane and found a satisfactory home at the seaside. They flew near enough so that they could inspect the rooms through the windows.



### Vanity Cases for Men the Latest London Fad

**"COPY cats!"** cry the women. But there—a man carries a pipe, a tobacco pouch, handkerchief, key ring, comb, nail file, and many other necessities that make his pockets bulge and wear them out. Why not a vanity case in which to carry all of them?

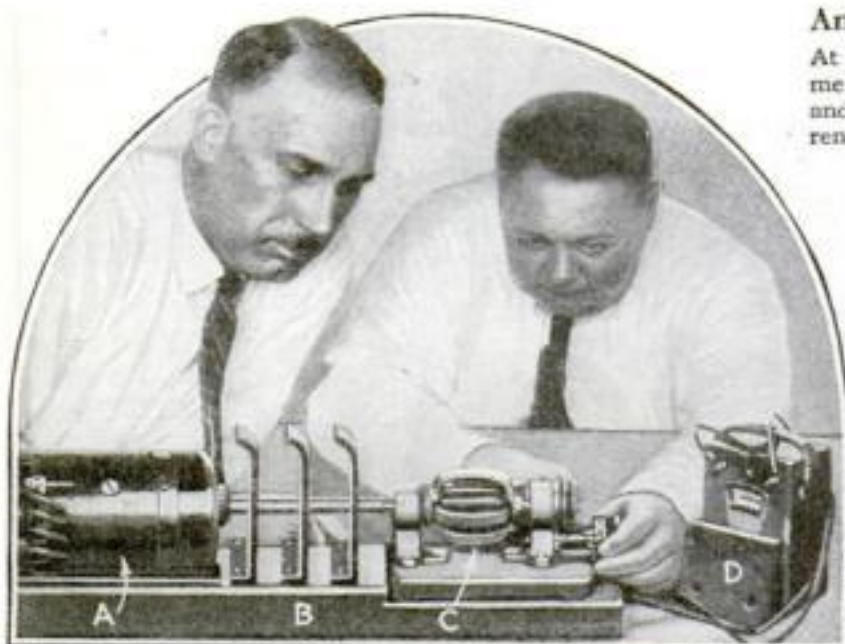
Vanity bags for men now are a fad in London and pretty soon they may hop over the ocean to us. There is also room for the ever-welcome extra collar. And don't overlook the mirror. But where, oh, where, is his powder puff?

### Crystal Gazing Is Said to Be Useful for Diagnosis

**C**RYSTAL gazing is not all humbug. It might very well be used in scientific diagnosis, suggests Dr. Lee Edward Travis, of Iowa State University, for crystal gazing is a way of making a person day dream, and this is a border line of the hypnotic state. Doctor Travis himself uses crystal gazing in diagnosing certain types of insanity and declares it has proved very effective.



# Electricity Guides Aviators in Fog



## An Automatic Pilot

At left: Apparatus that measures airplane's speed and drift by electric current generated in a moving coil as it cuts lines of force in earth's magnetic field. A—Motor that revolves cutting coil. B—Steel plates shielding coil from motor. C—The coil itself. D—Galvanometer that calibrates speed and drift in miles an hour. At right: Recording meter on plane's instrument board



**A**FTER seven years of experimenting, Thomas Willing Hicks and F. W. Adsit, of Minneapolis, Minn., have invented a device that they claim will end one of the greatest dangers in aerial navigation—loss of bearings. Many an accident has been caused when pilots were forced to land in order to find out where they were.

The location of aircraft can be ascertained only through knowing the exact ground-speed of the ship, the amount of side drift (how far the ship is pushed out of its course by cross winds), and the time that has elapsed since the ship started. These three values the Minnesota inventors have correlated into readings on an ingenious instrument.

The instrument, which is fastened in the rear of the fuselage of an airplane and wired to the meter placed on the instrument board, operates automatically and is intended to give the correct speed and drift reading without the necessity of sighting objects on the ground or in the sky. No calculations of any kind are required, the inventors say.

In navigating the air with the aid of the new device, the pilot consults a dial to learn his rate of speed. Another meter on the instrument indicates any side drift of the aircraft off the direct line of flight. From these two readings, in connection with the ordinary marine compass, so the inventors say, he may locate definitely his position on the map.

What has been discovered is a means of cutting the lines of force in the earth's magnetic field and measuring the amount of current generated from the earth's magnetism in a moving coil of special construction.

This coil, no larger around than a pencil, is made up of fine enamel-coated wires. When passing through the magnetic lines this produces a current, which, when passed through a meter, gives a reading indicating the ground speed of the airship. Another loop set at right angles to the first gives its drift.

Amplifying equipment may be used to increase the current generated by the coil conductors so that readings can be obtained even when magnetic field is weak.

# Block Signals Operated by Windmill

**I**N MONTANA, where the mountain-born winds sweep with a wild fury across the treeless plains, engineers have found a way to utilize this flowing sea of power to aid in the operation of trains. Only recently the Great Northern Railway put into operation a specially built wind turbine to generate electricity with which to operate its block signals.

The current developed by this windmill, at Culbertson, Mont., travels 10 miles in one direction and 16 miles in the other. Other windmills will be installed for signal operation on the 105 miles between Wolf Point, Mont., and Williston, N. D.

In perfecting the ingenious new method of harnessing the winds, a special alternating-

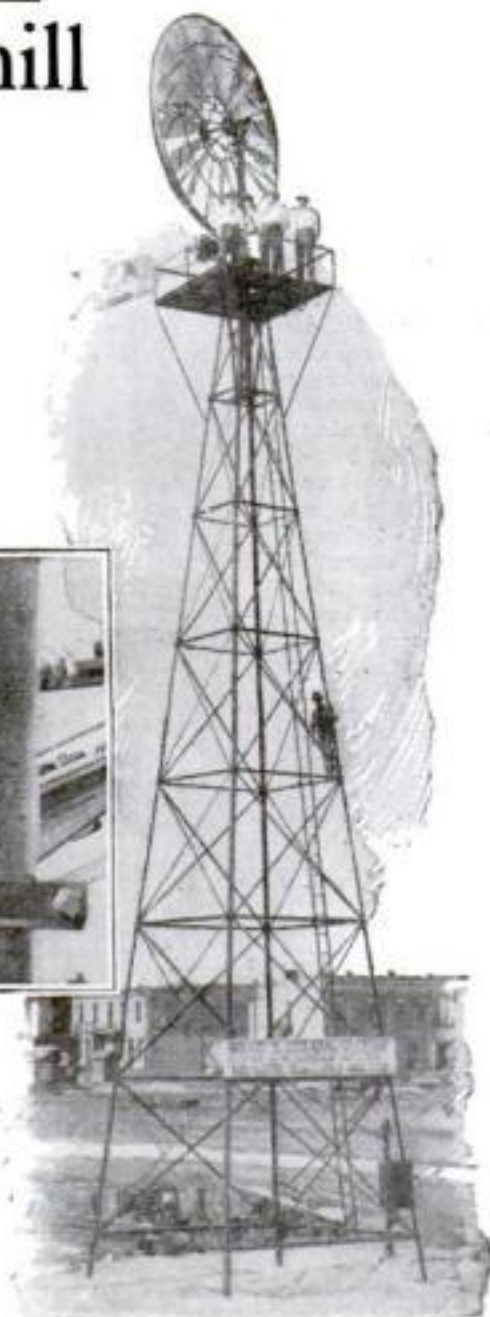
current generator had to be developed. The chief difficulty in generating alternating current by wind turbine is that of keeping the speed constant. This problem was solved through the use of a unique centrifugal governor that automatically furls and unfurls the blades as the wind increases or slackens.

The generator is located below the wind wheel. From it is obtained 220-volt alternating current. The wheel, which is 14½ feet in diameter, is mounted on a tower 62 feet high.



## Where Breezes Do the Work

Above: The 220-volt alternating-current generator, located immediately below the wind wheel. Notice how it is driven by a belt running through a jockey pulley. Left: Two block signals at Culbertson, Mont., lighted by power from the windmill, which is seen in the distance. Right: The windmill that generates the power. The 14½-foot wheel is mounted on a tower 62 feet high





# Invents Preservative after 987 Experiments

with as many heart-breaking failures. It was the nine hundred and eighty-eighth experiment that rewarded him with success.

The process of preservation is extremely

simple. Each article to be preserved is wrapped in tissue paper and packed firmly in a metal container. On top is placed a perforated cardboard shield, and on this

## Juicy as Ever

Below: How grapes appeared after three month's storage, and one of the cardboard trays used in packing



## Pears after Three Months' Storage

These pears had been shipped to England and back when the photograph was taken. It is claimed their texture and flavor were as fresh as when picked. Below: Edward Milani, inventor of new process



## Sealing the Fruit

The fruit to be preserved is graded as to size, wrapped in tissue paper, "gassed" with a special solution, and then hermetically sealed as shown above



**I**N SAN FRANCISCO there lives a man who believes in sticking to a job. He is Edward Milani, and as a result of his perseverance he claims to have perfected a method for preserving for months, meat, poultry, fish, fruit, and flowers in as good condition as when they were killed or picked.

Seventeen years ago Milani was in the wholesale fruit business. He thought it a pretty good business to be in, were it not that so much of the profit was lost by decaying fruit that had to be thrown away. And he began to wonder how he might prevent the loss. Today he finally has succeeded in discovering a way, but it took him 17 years and 987 experiments

a pine stick that has been soaked in a solution—the secret of the process. The container is placed in a sealing machine and the stick is ignited. When the flame from the combustible compound has reached its greatest height, the metal cover is pressed down and hermetically sealed.

The "magic" stick continues to burn until all the oxygen within the container is consumed. The oxygen is replaced by the gas generated by the composition and by the nitrogen left in the air. This halts decay. Shipments of fruit have been made to ports 30 and 40 days distant from San Francisco, it is said, and the fruit has been found to be as fresh as when it was first picked.

## Huge New Locomotive Designed to Take Sharpest Curves

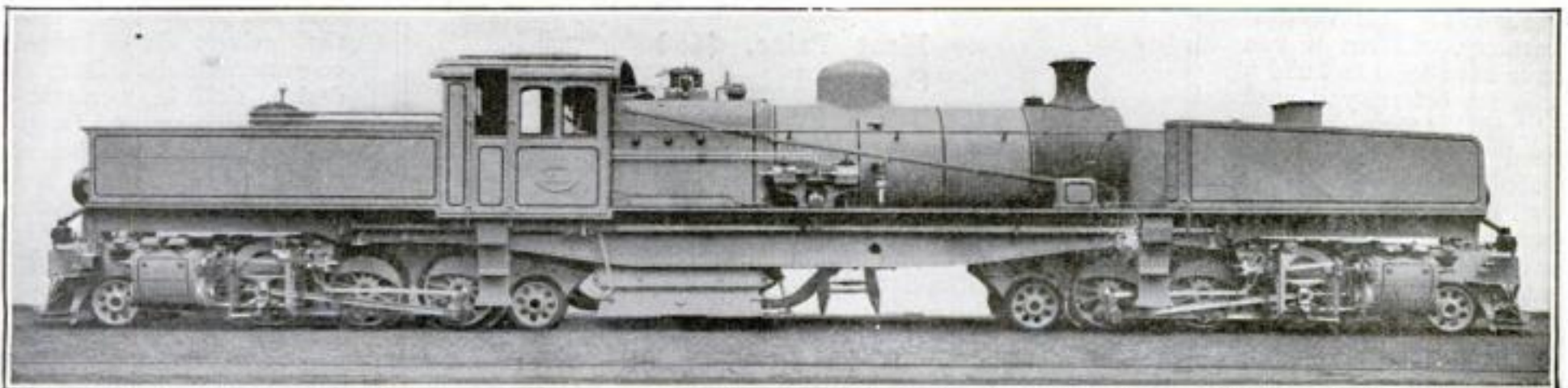
**A**LTHOUGH this odd-looking engine has a larger boiler than most locomotives, it is claimed by the makers to have greater flexibility when rounding sharp curves. The flexibility is obtained by means of two motorized pivoted wheel-trucks coupled at their pivots by a main girder frame. Each of the wheel-trucks

has a controlled swiveling movement.

Set at the front and rear of the boiler are the tanks and bunker. The truck-wheel pivots are so placed in their relation to the axles, that whether the bunker and tanks are full or empty, the distribution of weight is kept even.

Because the fuel bunker and the boiler

are rigid on the main frame, the fireman is not subjected to the usual jolting and swirling movements. This steadiness is particularly desirable on a line that has a succession of sharp curves. The engine fittings have been so arranged as to make them as accessible as possible to lubrication and repair.



Tank, boiler, and bunker are built on a rigid frame supported by two motorized pivoted-wheel trucks, coupled by a main girder frame



# \$225 in Cash Prizes in This Novel Radio Contest

Here is a fascinating competition in which you can build yourself a fine receiving set, and at the same time be paid handsomely for your trouble—You don't have to be an expert to win

**W**ITH this number, POPULAR SCIENCE MONTHLY introduces to you a new and remarkable form of prize contest, one that makes it possible for you to be paid as much as \$150 in cash just for building a radio receiver for yourself!

The idea of the contest is simply this: From a given number of instruments and parts, and from a specified wiring diagram, you are to build yourself a complete radio receiver—the best receiver you can make. Then, when the set is completed, you are to photograph it and send the pictures to the Radio Contest Editor of POPULAR SCIENCE MONTHLY, together with a short description of how you made it and how it works.

From all photographs entered, the judges will select the receivers that give evidence of the best workmanship and the highest skill in assembly and wiring. These will be put through actual working tests in the laboratories of the Popular Science Institute of Standards, and from them will be chosen the three best. To the builders of these three best receivers the following prizes will be awarded: First prize, \$150 in cash. Second prize, \$50 in cash. Third prize, \$25 in cash.

All entries in the contest must be submitted on or before January 15, 1926.

You will see at once that the beauty of this fascinating contest lies in the fact that you do not have to be a radio expert to win one of the prizes. Common sense and the ability to use care in working out a specific problem are all that is necessary. Even if you never have tried to build a radio set before, you need not fear that the money you spend for parts will be wasted, because, even if you should get tangled up in your radio construction, and should fail to make a set that will work, you can lay the parts aside and wait for detailed descriptions of the winning sets, which will appear in POPULAR SCIENCE

MONTHLY after the close of the contest. These will show you just how to complete your set so that it will bring in signals and put them on the loudspeaker.

The first thing to do, after you have decided to enter the contest, is to study the pictorial wiring diagram in Fig. 1 and the theoretical wiring diagram in Fig. 2. Neither of these diagrams shows you how to arrange the instruments in the receiver—that is a problem for you to work out. They do, however, show you how to

connect the instruments so that the receiver will operate with maximum efficiency.

The next thing is to obtain the following list of instruments that make up the set. The instruments are lettered to correspond with the lettering in the two wiring diagrams on the next page:

A, B and C—Any standard three-circuit tuning unit

D—Variable condenser (capacity to suit coil B of the tuning unit)

E—Fixed grid condenser, .00025 mfd.

F—Fixed condenser, .0005 mfd.

G—Fixed or variable grid leak

H—Rheostat to control detector tube

J—Rheostat to control amplifier tubes

I, L, and M—Standard vacuum-tube sockets

N—Medium ratio audio transformer (3 to 1 up to 5 to 1)

O—Low ratio audio transformer (not over 3 to 1)

P—Double-circuit jack

Q—Single-circuit jack

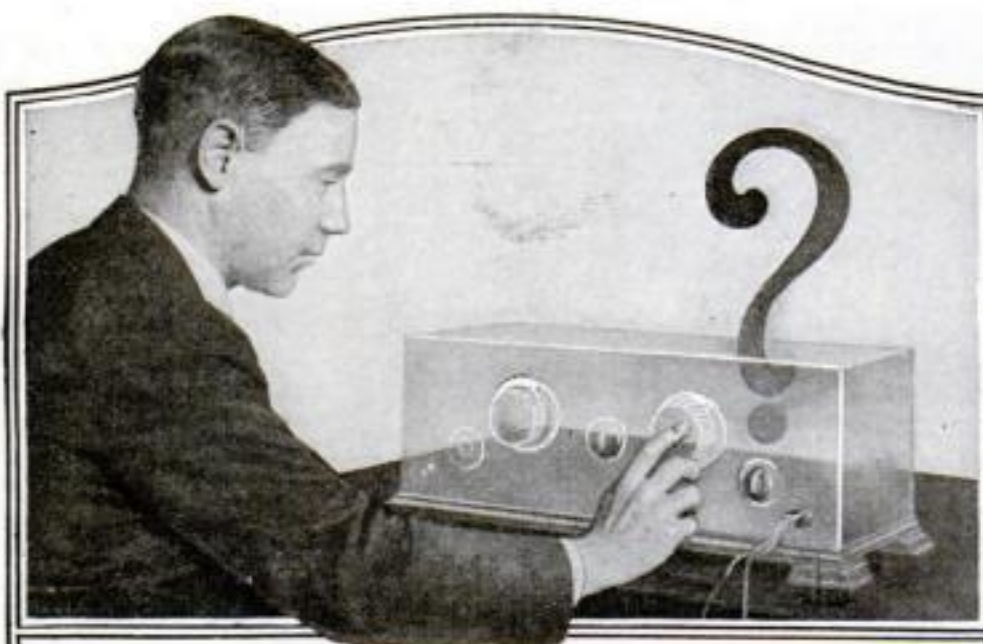
Dials, binding posts, panel, cabinet and bus wire as needed.

There are no restrictions whatever as to the makes of the parts to be used. You can use any brand you want or make them yourself if you have sufficient skill. Commercial apparatus and homemade apparatus will be considered on an equal basis in this contest.

Be sure to study the official rules for the contest as listed on page 147. This is important, since no exceptions can be made to the rules under any conditions.

Note particularly that the receivers will be judged on neatness and efficiency of design, skill in workmanship and wiring, and receptive qualities under actual working conditions.

You are permitted to use any size or shape of cabinet or panel. In other words, you can build the receiver on a long, low panel in a shallow cabinet, or on a shorter or higher panel fitted to a deep cabinet.



## How Will Your Set Look?

**Y**OU can learn from these pages how to build a fine radio receiver and at the same time compete for a handsome cash prize!

Here is your chance to develop your skill as a home radio constructor. You do not have to be a radio expert to stand a chance of winning one of the prizes. And even if you do not win a prize, you are sure to have a highly efficient radio receiver as compensation for your trouble.

This contest will give you an opportunity to exercise your mechanical ingenuity, your skill as a home craftsman, and at the same time put yourself in the running for one of the three following prizes:

**First Prize, \$150**

**Second Prize, \$50**

**Third Prize, \$25**

This contest is open to everybody. You do not have to be a subscriber of POPULAR SCIENCE MONTHLY. No coupons to send in—just build a radio receiver and send us two photographs of it, together with a description of how you put the set together and wired it.

Study carefully the rules and instructions.



Subpanel construction also is permitted, but the fact that your entry may be built with a fancy subpanel arrangement will not add to your chances of winning a prize unless the subpanel actually contributes to the efficiency of the receiver as well as its appearance.

It is not necessary that you build the receiver for one particular type of tube. You can decide for yourself as to whether you want to build a dry-cell operated receiver or one that draws its A-battery current from a storage battery. In judging the entries, due allowance will be made for the difference in results obtainable with dry-cell and storage-battery tubes.

WHILE the wiring of your finished receiver must conform in all essential details with Figs. 1 and 2, you can take some liberties with the number of binding posts, the number of rheostats, and the location of the C battery. Several binding posts in Fig. 1, you will notice, are connected. If the arrangement you work out for the instruments makes it seem desirable to use fewer than the specified number of binding posts, you are privileged to use fewer, provided you explain just why you made the change.

You also may use from one to three rheostats. That is, each tube can have a separate rheostat, or one rheostat can be used to control all three tubes.

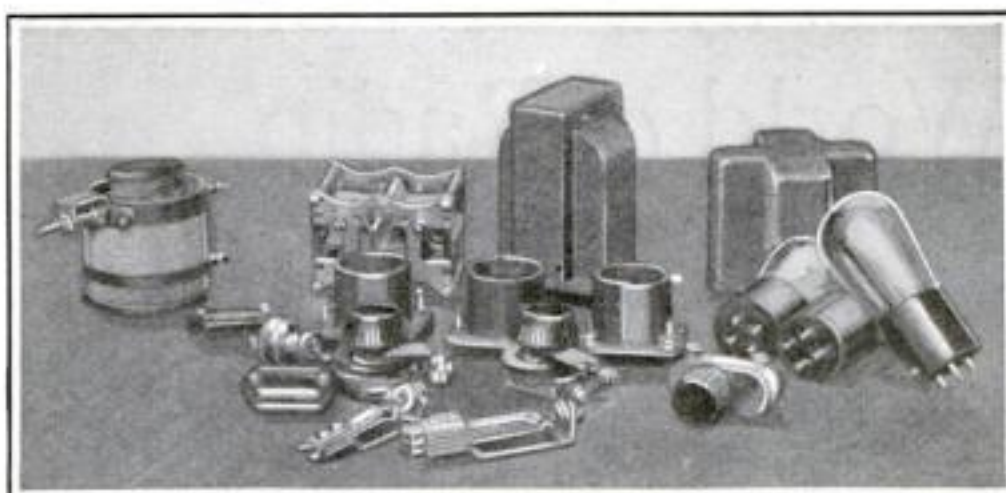
The C battery can be fitted inside the cabinet or connected with the receiver by means of binding post as shown in Fig. 1.

There is nothing in the rules about the kind of dials or knobs you are to use. You can use fancy Vernier dials or the simplest of plain dials. Pick out whatever in your judgment will make the panel of your receiver as attractive as possible. The judges will compare panels for neatness and general attractiveness.

FANCY carved or otherwise decorated cabinets and panels will not count as an advantage in this contest. You can build a very fancy outfit if your taste runs that way, but the fancywork will not influence the judges in selecting the prize-winners.

Do your wiring as neatly as possible. Round or square bus wire is to be preferred to ordinary copper wire because bus wire is stiff enough to hold its shape and a neater

## What Can You Make from These Parts?



Here are the radio instruments and parts that the prize contest calls for, and that you will have available for designing and building the best possible receiver, using the hook-up shown in the wiring diagrams below. Of course the parts you use do not have to be of exactly the same type as those pictured above. You can use any make you desire

job can be done with it. Be especially careful about soldered joints. Sloppy, careless soldering will ruin your chance to win a prize.

It is not necessary to purchase or make new parts. You can use any parts you happen to have on hand from old sets, provided, of course, that they are in perfect working order.

The finished receiver must be able to tune in all wave lengths between 235 meters and 560 meters, so be sure that the variable condenser has the proper maximum capacity to cover this wave band. The direction sheets that accompany most of the commercial three-circuit tuners specify the correct condenser to be used with the tuner to cover the broadcast band of wave lengths.

After you have completed the receiver

and have tested it to make sure that it functions correctly, you must take two pictures of it. One should be of the front of the receiver to show the panel arrangement, and the other should be of the rear of the receiver removed from the cabinet so that the arrangement of the instruments and the wiring will show clearly. These pictures should be not smaller than  $2\frac{1}{4}$  by  $3\frac{1}{4}$  and they should be as clear as possible.

Since this is a radio-construction contest and not a photo contest, the artistic value of the pictures you send in is of no consequence so long as they are clear enough to show the judges what your receiver looks like.

IN ADDITION to the two pictures, you must send in a short story about the set. Tell how you made it and how it works in actual use. Your story will not be judged on its literary quality, so don't worry about an occasional misspelled word or a few mistakes in grammar. What the judges want to know are the facts in the case, and it will be a help if you will write as clearly as possible so that your story can be read easily.

The officials of the Popular Science Institute of Standards will be the judges in this contest. They will go over every entry, study the pictures and read the descriptions. From all the entries they will pick out the receivers that appear to have the best chance of winning the prizes.

The owners of these sets will be requested to ship them by express C. O. D. to the Institute, and each of the sets will be tested and inspected under actual working conditions to determine the three winners of the cash prizes. After the tests, of course, the sets will be returned to their owners.

AS YOU will note from Figs. 1 and 2, the finished receiver will employ three vacuum tubes, and will consist of a regenerative detector and two stages of transformer-coupled audio amplification. The hook-up is such that no audio-frequency current is allowed to flow in the tickler coil C, and consequently the receiver will be free from the distortion ordinarily found in regenerative sets hooked up in the conventional manner. It is a

(Continued on page 147)

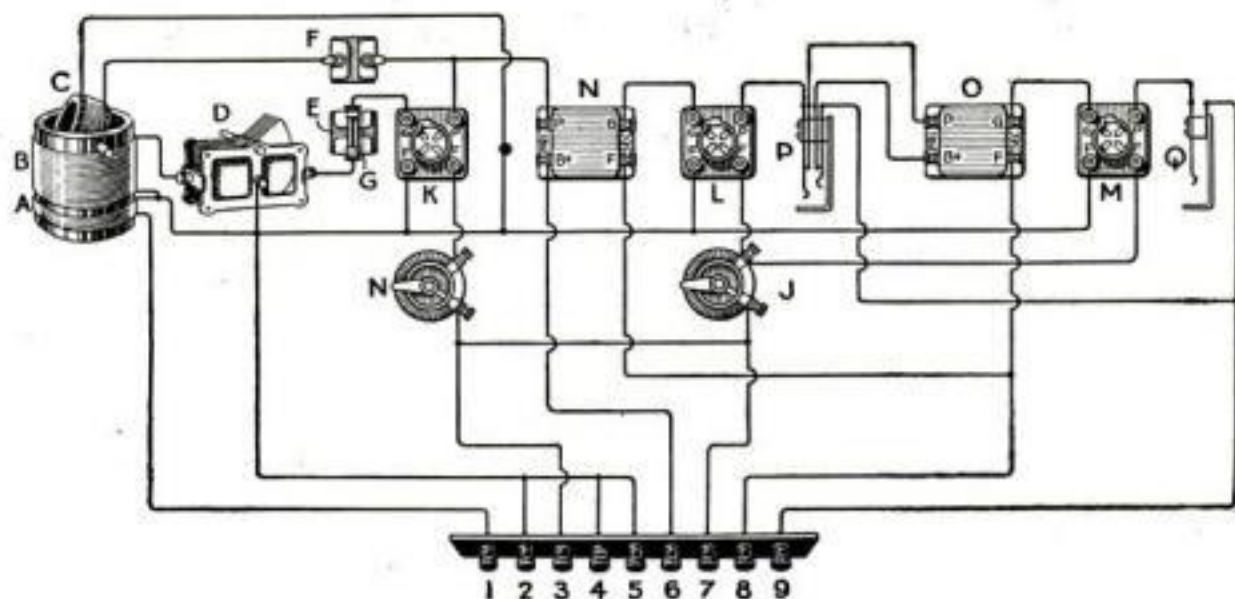


Fig. 1. Pictorial wiring diagram of the hook-up to be followed in building your prize contest set

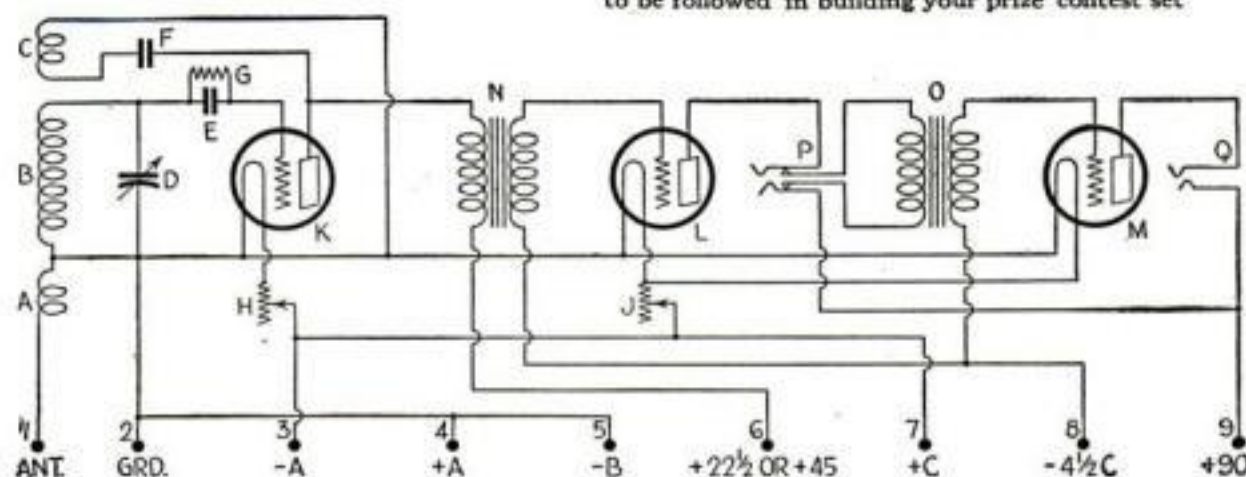
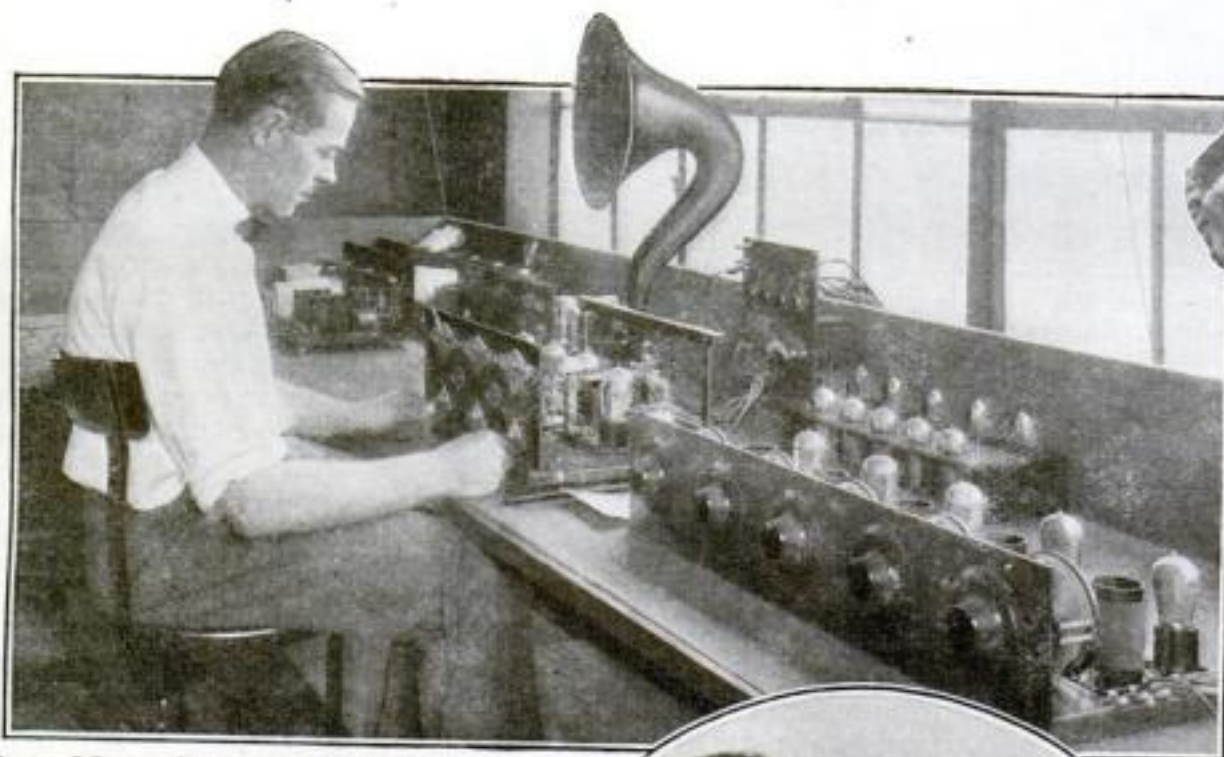


Fig. 2. Theoretical wiring diagram. Neither of these diagrams show you how to arrange the instruments in the receiver. That is a problem you must work out



# Novel Ideas *and* Inventions in the World of Radio



## How New Sets Are Tested

No doubt you have wondered how high-class radio receivers on the market today are designed to operate with such marvelous precision. This picture shows an expert in a large Eastern factory testing the tuning accuracy of a receiver by a master oscillator



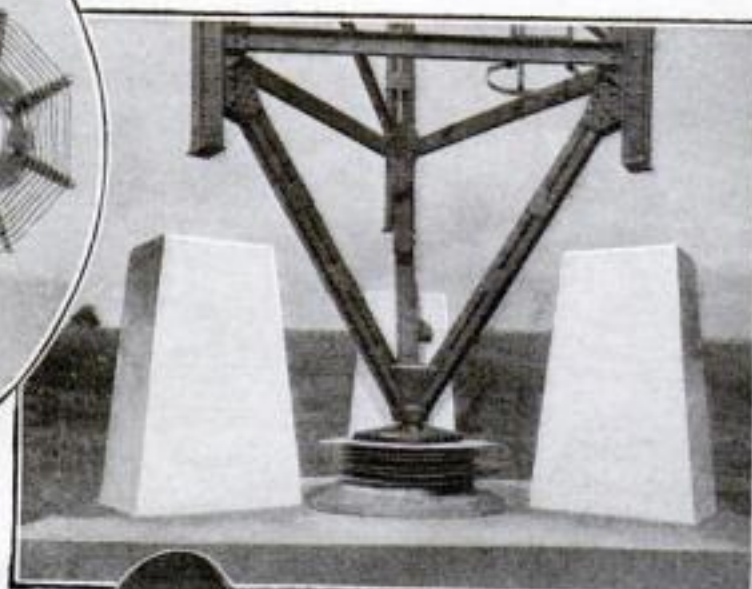
## Novel Tuning Loop

Tuned very much like a variometer, this new loop, invented by Stewart C. Whitman of New York City, is said to greatly increase the signal strength. The loop is adjustable to any receiver



## A Steinfuf of Radio

At last they've found a use for old beer steins. This one, exhibited at a recent New York radio show, houses a crystal set that operates with high efficiency



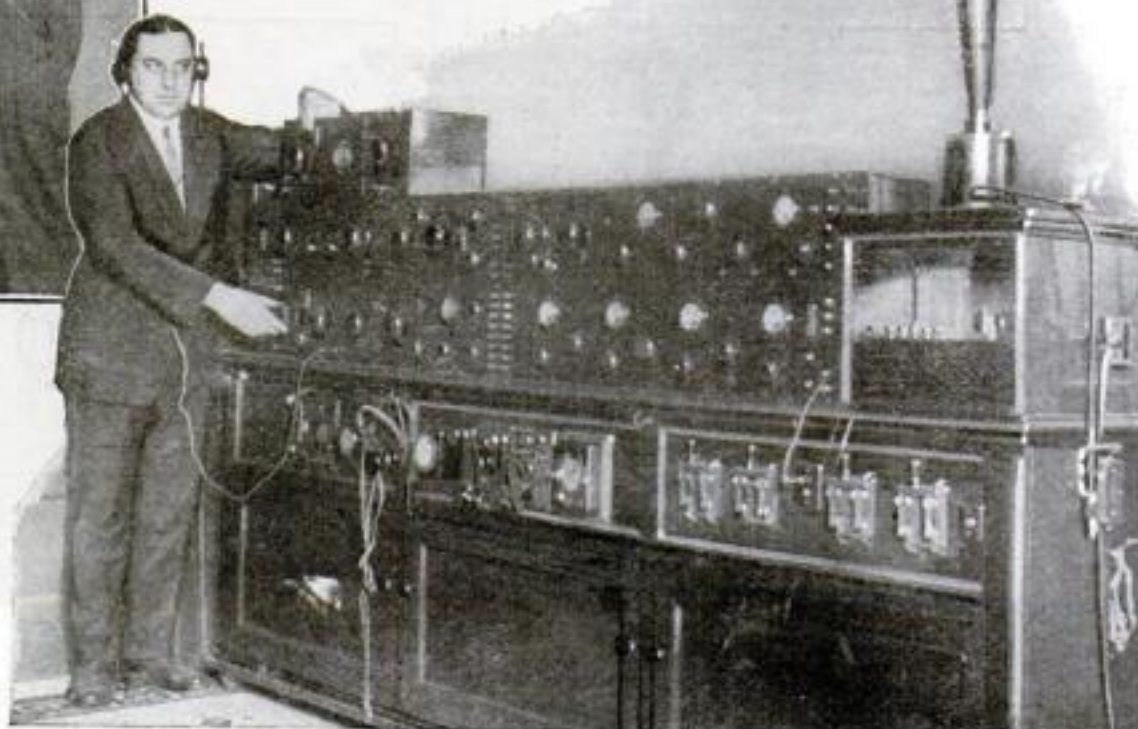
## Mast Rests on Glass

The base of this 400-foot steel radio mast at Penant Hills, Australia, rests on a pile of heavy glass plates. Broken plates can be replaced by placing jacks on the concrete pillars and raising the mast



## Radio for Egypt

Here is I. H. El Kordi, special emissary of King Fuad I of Egypt, studying radio communication in one of the radio-manufacturing plants in the United States. When he has completed his radio education, he expects to return to Egypt and build several radio-broadcasting stations for his government



## Huge Set Has 23 Tubes

Robert J. Sieglack of Sheepshead Bay, N. Y., designed and built this remarkable 23-tube radio receiver. It employs a special super-heterodyne circuit and the parts alone cost about \$3000. He claims to bring in European stations with loud-speaker volume



# What a Radio Service Man Has Learned about Your Set

"You wouldn't try to run a car without gasoline, but thousands try to operate receivers with dead batteries," says expert who has installed hundreds of sets—Peculiar and amusing problems he encounters in a day's work

*As told to John E. Lodge*

NOT long ago the boss sent me around to a swell apartment house to install a high-priced radio outfit. I'm the head installation and service man in one of the biggest radio stores in the East. My job is to install the sets we sell—and then keep them working. In the store they call me the "trouble man." They're right. I have plenty of troubles.

My troubles begin from the moment the order is booked by the salesman. In about nine cases out of ten, they continue until the customer awakens to the fact that, if he'll do a little studying on the instruction book that came with his radio set and use a little plain horse sense, he can keep the set operating satisfactorily without telephoning for the trouble man.

The installation of the set I'm talking about started off exactly as had a couple of hundred other installations I had made in apartment houses—with a scrap with the janitor. Although there were already two aerials on the roof, he insisted that it was against the rules to install radios in that house.

I began talking radio with him. In a few minutes he confessed that one of the aerials on the roof belonged to him and that his set wasn't working just right, so I went down to the basement and fixed it for him. Then the two of us returned to the roof—and he helped me put up my aerial. The hour's time I spent with the janitor went on the bill of the man for whom I was making the installation. He could have saved it by speaking to the janitor and arranging matters before I arrived.

THERE were two kids in the apartment where I was to make the installation—lively, healthy youngsters, naturally all excited about the radio set. They kept under my feet all the time I was working, mixing up my tools, playing with the set and bothering me otherwise. Meanwhile their mother kept pestering me with a lot of fool questions—how far would the set receive? Did I think they would be able to get London that night? Did I think this was a good set? Why

couldn't I use ordinary electric lights instead of those bulbs? Why wasn't one battery enough for the set? Why couldn't I run it from a wall plug, the same as she did her vacuum cleaner? It took me twice as long to get the set installed as it would have if they'd let me alone. That went on the bill, too.

FINALLY the job was finished. I spent a solid hour showing the lady how to turn the dials to tune in stations. I marked the portions of the instruction book that I figured she'd need most at first. I gave her a hydrometer to test the storage A battery, and a voltmeter to test the B battery, told her to be sure to keep the A battery charged, and beat it back to the store.

Just as I was about ready to quit that evening, I was called to the phone. It was the lady in the apartment house.

"That set you installed today is broken already," she told me. "The regulator won't work at all. Won't you come round and fix it before my husband comes home?"

Of course, I couldn't figure out

what the "regulator" might be, but I hurried right around to the apartment. That was an expensive set, and I wanted it to stay sold.

"Look here," she greeted me when I arrived. "I've been turning this knob" (one of the rheostats) "and turning it, and turning it—and I can't slow the music down at all. Listen—it's going much too fast."

Now I ask you, can you beat that! The only idea she'd taken away from the hour's instruction I'd given her was that, by turning a knob, you could slow down or speed up the music as you do in a phonograph! Probably thought the knob was connected by radio with the orchestra leader's arm.

WELL, I explained things to her as best I could. She was a little puzzled and disappointed, but at last she made up her mind that I wasn't just trying to make excuses for a defect in the set, and let me go. That was the last I heard of her for about two weeks. Then she called up to tell me that the "lights" in the set wouldn't light any more.

I trotted around again, and found just what I expected. The storage A battery was as dead as Adam's cat.

"My goodness!" she exclaimed when I told her what the trouble was. "I don't see how that could be. Why, my husband put water in the battery just the other night."

"Did he charge it, too," I asked.

"Oh, yes," she assured me. "He had the charger on one night all the time we were at the movies."

Radio fans who know what a storage battery is and how to take care of it can understand what I'd like to have said. I explained to her that the hydrometer was for testing the battery—not just a syringe to squirt distilled water in with. I also told her that the set consumed about half the amount of current each hour that could be put back into the battery by an hour's charging; in other words, that for every hour she used the set, she ought to charge her battery for

half an hour. That went over her head, so I compromised by telling her to turn on the charger overnight twice a week,



A Lesson in Hydrometers

"I explained that the hydrometer was for the purpose of testing the battery—not just a syringe to squirt distilled water in with"



and decided to let it go at that.

About 90 per cent of the trouble-shooting calls I go out on turn out to be due to dead batteries or worn-out tubes. In such cases it often requires a lot of tact to tell the customer what the trouble is without ruffling his feelings. Those of us who have been on the job for some time realize that the average man or woman who buys a radio set does things or forgets to do things that seem childishly easy to us merely because radio happens to be the thing we know best.

One of my hardest jobs is to hire assistants who can go out on a trouble call without trying to act high and mighty when they discover that the set-owner doesn't know as much as they do.

**A** LOT of little problems crop up in radio trouble shooting that are interesting enough to take the monotony out of our jobs. One day a customer phoned to complain that the music was so weak he could hardly hear it.

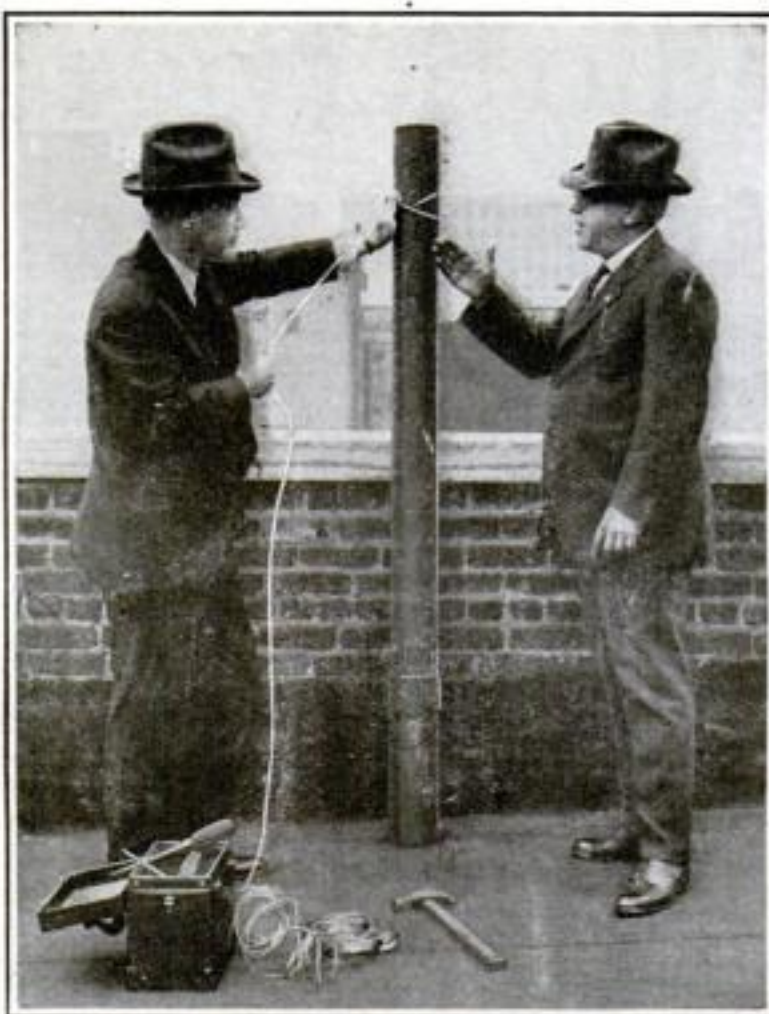
"More dead batteries," I said to myself. So I loaded a couple of new B batteries and a fully charged A battery into the flivver and drove around to his house.

But this time it wasn't batteries. They checked up fine. The local station about a mile away came in loud enough, but it tuned as sharp as a knife. That is to say, instead of being audible over a large portion of the dial, it faded out entirely unless the dial was set just right. That indicated among other possibilities, that something might have gone wrong with the antenna, so I headed for the roof. The customer went with me, and he nearly burst with indignation when we discovered what the matter was. One of the other tenants had calmly appropriated his antenna! No wonder the signals were weak. They had to get to the set by way of about 30 feet of lead-in wire which was in contact for most of its length with the tin roof.

This matter of stolen antennas is causing trouble for a lot of radio listeners. It's astonishing how many antennas are "borrowed," especially when there are a lot of them on one roof—at an apartment house, for instance. Many are cut down by workmen, too, if they happen to need a piece of wire. Many people take out personal grudges against their neighbors by sneaking up to the roof with a pair of wire cutters and reducing antennas to little pieces. That happens most often to the bird who insists on running his loud-speaker on full volume late at night or to the pest who lets his regenerative set howl and squeal.

**WE USED** to get many trouble calls from people who kicked because they could not hear some distant station about which they had read. Complaints of that kind are falling off now, mainly because the public is beginning to get wise to the fact that distance reception is pretty much of a gamble, no matter what set you buy.

It's a hard job, as you'll believe, to satisfy a new radio enthusiast that he is



"Making Up" with the Janitor

"When the apartment-house janitor insisted it was against the rules to install antennas on the roof, I began talking radio with him and helped him fix his set in the basement. After that he helped me put up my aerial"

getting all he is entitled to in the way of distance reception if the set was advertised to bring in stations a thousand miles away and he can't do it.

Most radio fans, and that includes a lot of the old-timers as well as the beginners, don't realize what an important bearing location has on distance reception. A woman who lives about 10 miles out of town bought a medium-priced outfit at our store. I was sick at the time, and a new man made the installation. When I

got back, the boss told me the woman had called up to complain that her set didn't work right.

I checked the new man's installation work to be sure that he had not forgotten to connect the batteries or something else equally foolish. Then I clamped the head phones on my ears and tried to tune in a station about 20 miles away which, according to the program in the paper, was broadcasting at that particular moment.

**I GOT** the station all right, but so faintly that I don't wonder the woman wasn't satisfied. I tried some other near-by stations with practically the same results. It really required expert tuning to get anything at all. There was nothing whatever the matter with the set; it was working fine, but there was something radically wrong with that particular location as far as the reception of radio was concerned.

Of course, there was only one thing to do. I told the woman frankly what the trouble was and offered to take the outfit back and refund her money or credit it toward payment for a set which would do the work. She took me up on the latter offer, and you may be sure that I took pains to

install the more powerful outfit myself!

We have had a lot of cases like that, although most of them are not quite so bad. Generally in a city or town, reception is bad in one or two localities. In fact, the boss has got to the point where the first question he asks a prospective customer is, "Where do you live?" Then if it's in a location where we have found reception to be below par, he concentrates on trying to sell a powerful set.

Besides the dead battery and tube problem, we run into a whole raft of other troubles. You'd be surprised at the number of times I have gone out trouble shooting only to find that the owner of the radio set had failed to push the loud-speaker plug clear in, or that the set wasn't even turned on.

**EVERY** time there is a bad thunderstorm or the static is particularly heavy we get a lot of calls from customers who want a man to come around quick because the set is very noisy. Every time broadcasting stops for an SOS there are calls, too. Then there are troubles with interference from near-by electrical machinery; not only from power stations, but from household appliances run at the same time as the radio set. The madam gets a new violet-ray outfit to improve her beauty and friend husband hears a terrible noise from the loudspeaker. Electric fans, vacuum cleaners, washing machines—whether your own or your neighbor's—are likely to punctuate your radio music with queer noises.

After all, a radio receiver is a piece of machinery and like any other machine, the results you get out of it depend mainly on how well it is operated. Learn your set—its quirks and peculiarities. Then your calls for the radio service man will be few and far between.

### *If Your Set—*

**SQUEALS**—Try cutting down on regeneration (volume control) if you have a regenerative set. Try changing the tubes around in the sockets if you have a tuned radio-frequency set

**GOES DEAD**—Probably the batteries are exhausted, the tubes are burned out, or a wire is disconnected

**GIVES WEAK SIGNALS**—Tubes may be worn out, batteries run down, antenna down

**SOUNDS TINNY**—Readjust the loudspeaker

**BALKS, THOUGH TUBES LIGHT**—B battery dead or disconnected

**WON'T RESPOND**—Study the instruction book, check each point carefully. If the set still refuses to work, send for the service man.



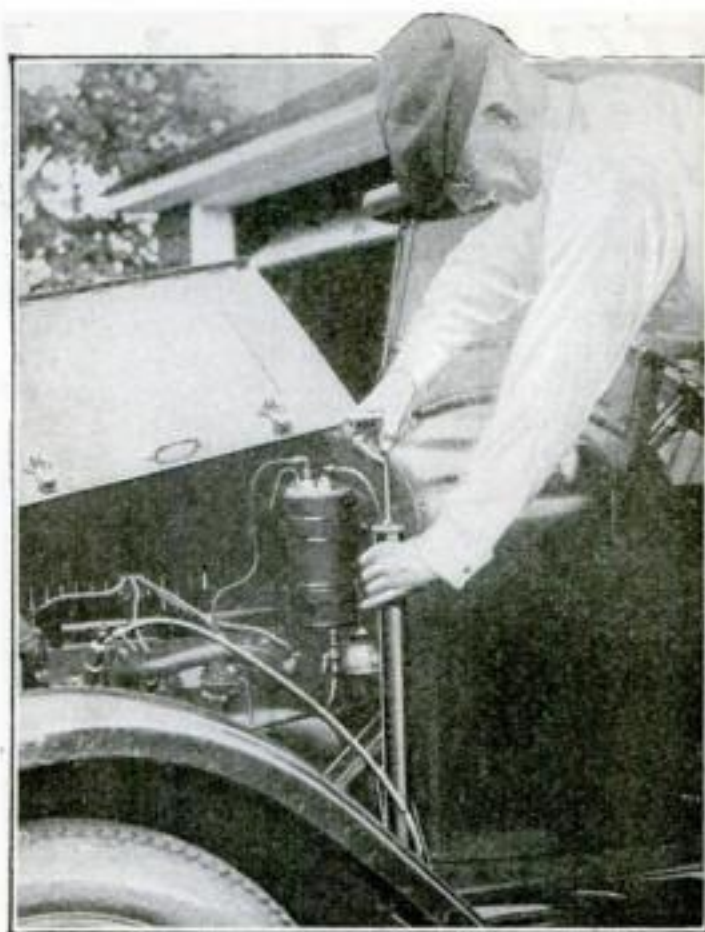
# Novel Ideas for Auto and Garage

## *Useful Tools and Accessories*



### One-Hand Oiler

By squeezing the handle like a pair of pliers, a unique auto lubricator (left) can be operated with one hand. It develops about 7000 pounds pressure, owing to the enormous leverage. The lubricant is carried in the round container



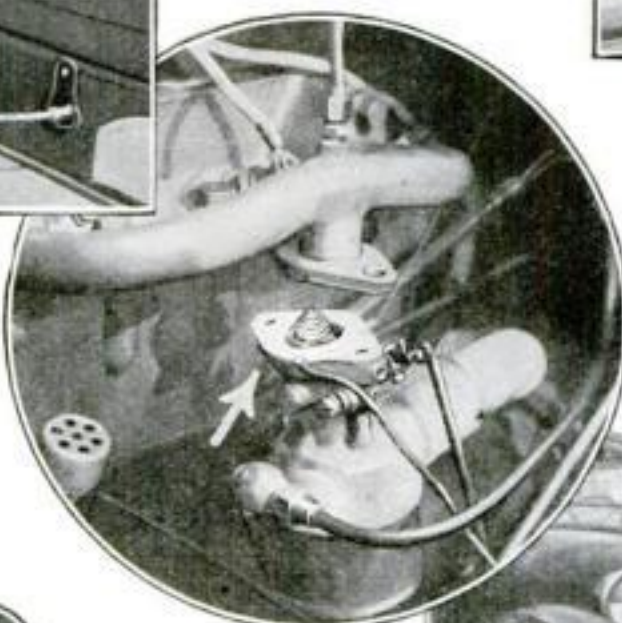
### Handy Auto Trouble Finder

This new pump sucks as well as compresses. A special fitting is screwed into the spark-plug hole. With this device it is possible to locate loose bearings, leaky valves, and worn piston rings without the need of taking the motor apart



### Light where You Need It

Plenty of light right on the work is a great help in auto repairing. As the illustrations below and at the left show, this light can be moved about and centered exactly where needed most



### Electric Primer for Winter

The insulating gasket between the carburetor and the intake manifold supports a spiral heating coil, which is connected with the storage battery, so that it can be switched on to heat up the manifold a minute or two before using the self starter. The motor starts without the use of the choke

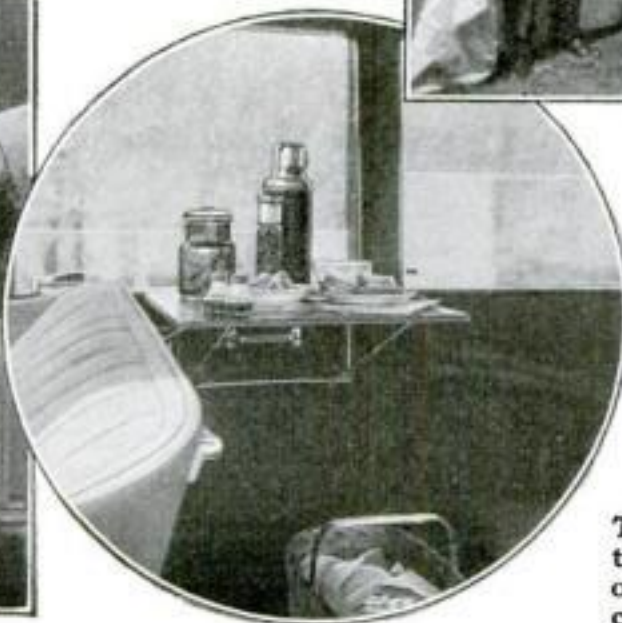


### Bumper Forms Bed Frame

Pulling out the front section of the bumper as shown in the two illustrations above, forms a rigid framework for the auto-camper's bed. This ingenious arrangement can be used in place of either the front or rear bumper of standard construction

### "Stop" and Turn Signal Switch

The red "stop" light in the tail-light and license bracket illustrated at right is operated in the conventional manner by means of a switch connected with the brake pedal. Two semaphores are provided and they are controlled by means of a lever on the auto's steering-wheel

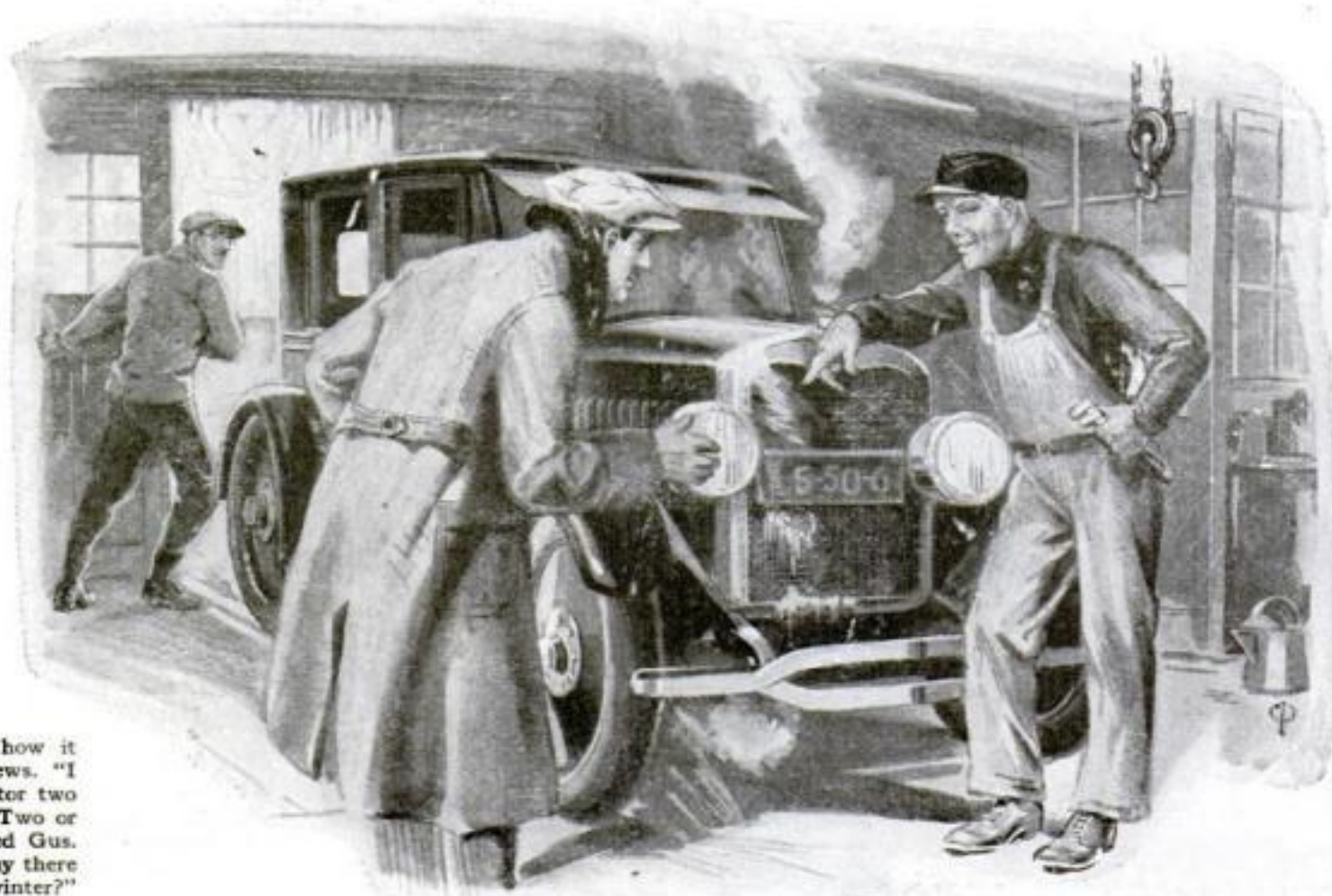


### Compact Table for Autos

The folding automobile table shown at the left is built so that it can be hooked over the back of the front seat in open cars and to the door handle in closed cars



# When Jack Frost Hits Your Car



## Frozen!

"Blamed if I can see how it could freeze," said Mathews. "I put alcohol in the radiator two or three weeks ago." "Two or three weeks ago!" scoffed Gus. "Did you expect it to stay there for the rest of the winter?"

## Gus and Joe Tell How to Keep the Works from Freezing—Some Useful Hints for Easy Starting

By Martin Bunn

"HEY, Gus!—Joe! Open the door!" Mathews yelled at the top of his lungs, as he pulled up in front of the Model Garage one bitterly cold morning. Billowing clouds of steam were rolling up from underneath his car and the driver was apparently in no mood to wait calmly.

"Righto! Just a second—the door's stuck," came faintly to Mathews' ears, followed by a vigorous thumping that jarred the door loose.

Mathews drove in, shut off the ignition, climbed out, and began rubbing his ears vigorously.

"Dang it! Look at her steam!" he growled. "You ought to be ashamed of yourself, Gus, for fixing that pump so rotten the last time. It's busted already. Worked fine when I started out, but before I'd gone a mile she started to blow off like a durned old tin kettle."

"Humph!" grunted Gus non-committally. "So the pump has gone bad, has it? Well, then, how do you account for all those fancy looking icicles hanging on the radiator?"

"What icicles?" snapped Mathews. "Can't you see it steaming? How could there be icicles—"

"Well, I'll be durned!" he gasped amazedly as his eyes took in the long streamers of ice. "The radiator was all right when I left the garage; not a leak in it. I looked at it specially, because it is so cold this morning."

"Yes," said Gus, "and the reason it didn't leak then was because ice doesn't run like water. You probably had a radiator full of ice right then. In a few

hours more, the water in the cylinder jackets would have frozen solid, too, and then you would have had to pay for something besides a leaky radiator, I can tell you!

"When you got the motor started, the pump worked all right, but the ice in the bottom of the radiator kept the water in the cylinder jackets from circulating, and it just naturally had to boil. Then the steam started to thaw out the frozen part of the radiator and the water ran out of the burst seams, hit the cold outside air and formed icicles."

"Blamed if I can see how it could freeze, anyway," said Mathews. "I put a lot of alcohol in the radiator not over two or three weeks ago."

"Two or three weeks ago!" scoffed Gus. "Did you expect it to stay there all winter? After that warm spell last week, I'll bet there wasn't much more than a smell of alcohol left this morning. That's the trouble with alcohol. It evaporates so quick. No doubt about its being the best anti-freeze compound, but you have got to watch it careful—"

"JOE, show Mathews one of those alcohol hydrometers we got in last week. That's the answer to the question of how much alcohol you've got in the radiator. See," he directed, as Joe handed him a glass tube with a little float inside. "It works just like an ordinary battery hydrometer only the scale reads the other way. Alcohol makes the water lighter, and this shows just what

temperature the solution will stand without freezing by floating higher or lower on the scale."

"Bet you that won't be the only freeze-up job we'll get today," said Joe, as Mathews, convinced at last that the freezing was his own fault, left the garage.

"What's the use of betting against a sure thing?" replied Gus. "There's the next one on the phone right now," he muttered, as he clamped the receiver to his ear.

"MODEL Garage—Wilson speaking. What can I do for you?" said Gus.

"This is—McKay—Gus—can't get the old—boat going—this morning—come out and help me!"

Evidently the man at the other end of the line was all out of breath.

"What's the matter—battery gone down on you?" Gus inquired.

"Sure," answered McKay. "But that's not all. I've been turning her over by hand till I'm all tuckered out, and I can't get a pop out of the motor! Be a good sport, Gus, and come out right away, won't you?"

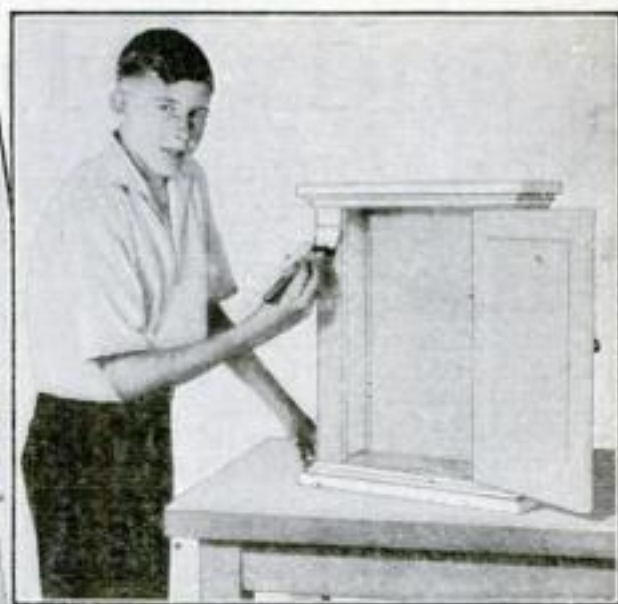
"All right," said Gus. "I'll be up there in about 10 minutes."

McKay was a good customer of the Model Garage, and a good scout, in the estimation of the garage men. But what he didn't know about the interior mechanism of an automobile would fill a large book chock full.

By the time Gus got there, McKay had cranked the motor over and over until he

(Continued on page 163)





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# Handy Hints for Car-Owners

## Simple Emergency Jack—Half a Dozen Other Useful Tips

**B**ALLOON tires, because of their larger diameter, let the axle down much nearer the ground when they go flat than do ordinary high-pressure tires. A number of special jacks now are made for use with balloon tires. They are constructed so that they will get under a very low axle. If you happen to get caught with a flat balloon tire and an old-style jack, the stunt shown in Fig. 1 will enable you to change tires. Lift the axle as high as you can by the lever method shown in the illustration and then block the axle in position while you put the jack under it in the usual manner. This method also is useful to get a wheel out of a deep mud hole.

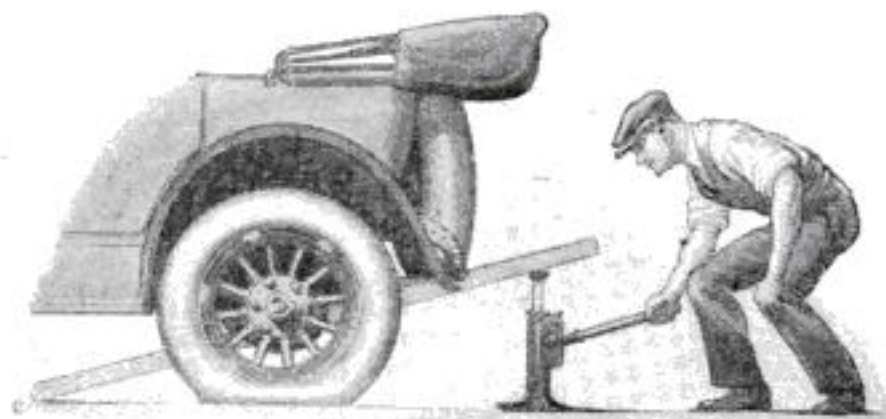


Fig. 1. How to use a wooden beam to advantage as a lever in jacking up a wheel equipped with balloon tire

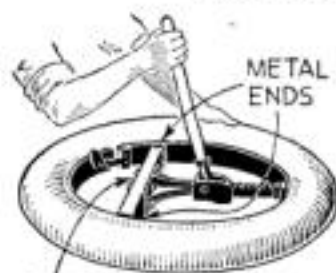


Fig. 2. Expanding tire rim with auto jack



Fig. 3. Garage door bolts made from pipe driven into the ground

Fig. 4. Left: How to straighten a bent bumper with a jack

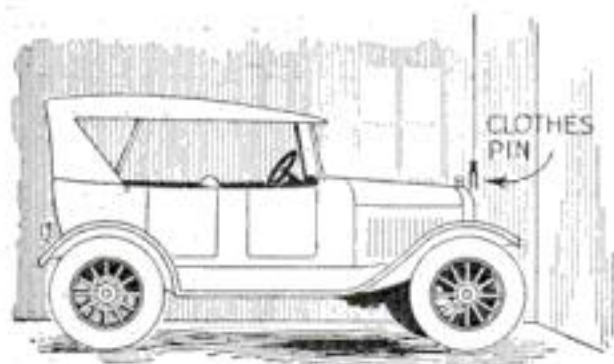


Fig. 5. A suspended clothes-pin serves as a guide in driving the car into the garage

**A** BENT bumper certainly detracts from the appearance of any car, yet most auto-owners hesitate about dismounting the whole bumper just to have the kink removed. Study Fig. 4 and you will see how an ingenious garage man has solved this problem. The most common bend is at the end, where a passing car has hooked on to the projecting end of the bumper.

As shown in the illustration, the way to take out such a kink is to get the end of the bumper at a convenient distance from a wall and then, after blocking all four wheels as solidly as possible, force the end of the bumper back into position with a jack braced against the wall.

Center bends can be straightened by bracing the base of the jack against the

frame and pushing the bumper outward as shown.

**I**N DRIVING a car into a small garage, perhaps the hardest part is to judge when the car has been driven in far enough so there will be no difficulty in closing the back door.

One simple solution of the problem is to get the car into the best possible position and then hang a clothes-pin from above so that it will just touch the radiator cap, as shown in Fig. 5. After that the owner need only drive in until the clothes-pin touches the cap and he will be absolutely sure that the back door will close.

**A** SIMPLE tool for the easy removal of felt packing can be made by bending a piece of heavy wire into the form of a corkscrew at one end, with a loop at the other end for a handle. As shown in Fig. 6, the wire end is screwed into the felt grease retainer and pulled out like the cork from a bottle.

**T**HERE is one place where the tire gage does not belong, and that is in the toolkit, where it is sure to get clogged with dirt and damaged

by heavy wrenches and the tire jack. A good way is to buy a fuse clip the right size so that the tire gage will snap in tightly, as shown in Fig. 7. The clip can be fastened to the inside of the dash, where it will be protected, yet handy.

**I**F YOUR car is not used daily and consequently is idle for as much as a week or two at a time, it is a mighty good idea to turn off the gasoline at the valve which is always placed between the vacuum tank and the carburetor. Frequently, difficulty in starting can be traced to an empty carburetor and vacuum tank, caused by a slight leak in the needle valve which controls the supply of gasoline to the float chamber. A leak so small that it will not cause gasoline to drip, is sufficient to exhaust the supply stored in the vacuum tank.

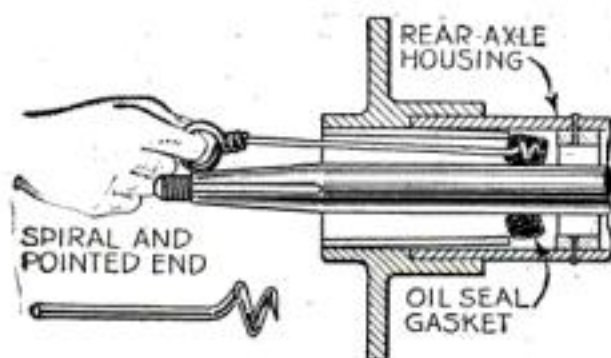


Fig. 6. This homemade corkscrew of heavy wire is useful in removing felt packing

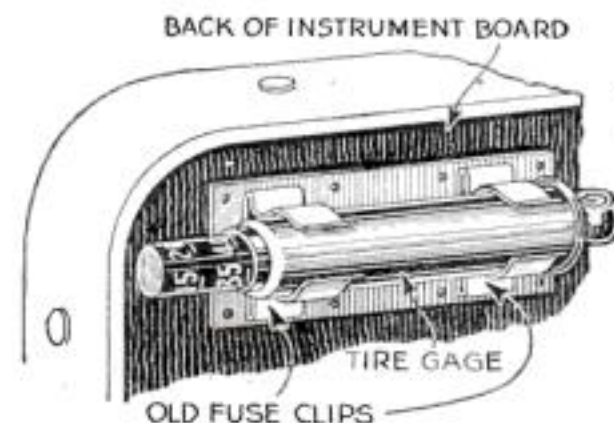


Fig. 7. A handy tire-gage holder on the dash, made from a correct-size fuse clip



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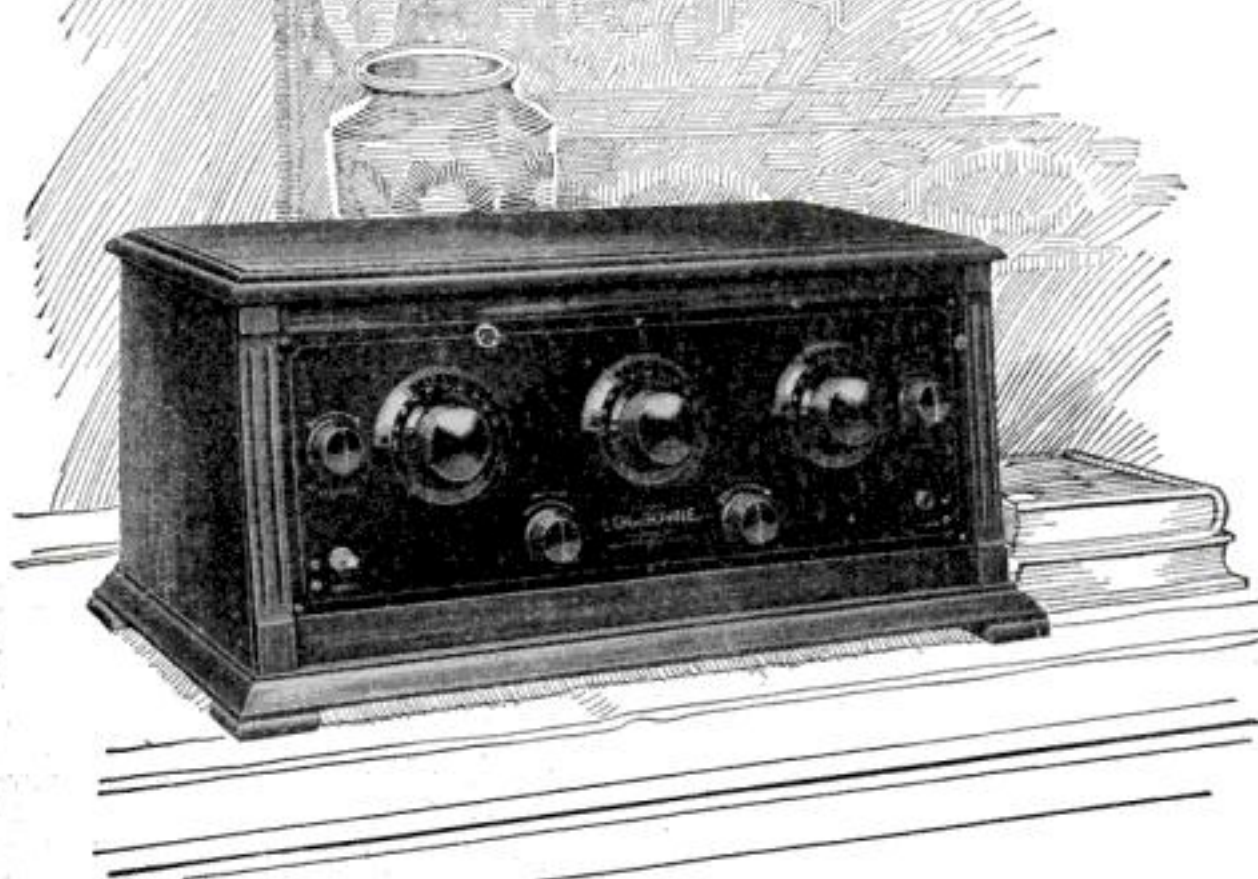
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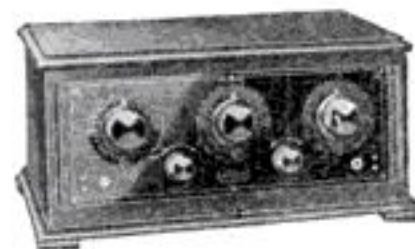
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# The Home Workshop

Arthur Wakeling, Editor

## Your Christmas Tree

*How to Set It Up, Keep It Fresh and Make the Decorations*

By A. Neely Hall

*Noted Authority on Handicrafts in the Home*

WE KNOW 12 months in advance what we must plan and do for the holidays, yet the season is generally upon us without our having made any preparations. In the eleventh-hour mad scramble to complete our shopping, little time and thought are given to the tree and the home decorations. True, by organizing our time so that we have a Thomas Edison working schedule of 20 hours or so, we manage to get through with it all, but there is always this and that we would have done differently had there not been so much hurry.

One of the penalties of last-minute preparations is a misshapen tree. The best have been picked out when we go forth to buy, and we must take what is left and make the best of it. Whereas, had we been foresighted enough to place an order the day the trees appeared in the market, we might have had a beautiful and symmetrical tree stowed away, awaiting the time for trimming.

The thing to do with an ill-shaped tree is to set it in a corner of the room with the best side out or, if it is very scrawny, to buy a second tree and bind the two together. Sometimes only a branch is lacking to make a tree symmetrical; in

this case if you look about, you will find an inexpensive tree having a limb of the right length and shape, which you can lop off and splice to the tree trunk.

The secret of keeping the tree green is to place it in a room where the atmosphere is cool and moist. The cooler you keep the tree, and the farther from a radiator or register, the better. The way to supply moisture is through the trunk, by standing it in a receptacle filled with water. This requires a specially made base. Several manufactured bases embrace this idea, but you can make one that will answer your purpose just as well.

The photograph shows a water-filled base that I have used for our tree for a number of years. A square box and a pail of 10- or 12-quart capacity with a means of supporting the tree therein, are all that this base requires.

Figure 1 shows the box with pail in place, the tree support, the cover, and the assembled stand. A grocery box can be used. If it is longer than it is wide, it will not matter, though it is no trick to cut down the length of a box to make it square. If the pail is a snug fit for the box, good; if not, nail wooden blocks or strips to the box sides and ends to fill out the space between them and the rim of the pail. If the tree is large, the base must be heavy to prevent upsetting, and a good plan is to pack the space between the pail and the box sides with earth or sand.

TO SUPPORT the tree, make a mast-step similar to that shown; it should fit snugly in the pail bottom. You can bore the hole for the tree trunk, and if you haven't an expansive bit to set to the



The secret of having a symmetrical, fresh-looking Christmas tree is to buy it early and keep it standing in water

right diameter, you can bore a ring of holes and cut out the wood between with a chisel; or you can use two blocks of wood, cut a V-notch in the edge of each, and fasten together with battens, as indicated.

The top of the box must have an opening for the tree trunk, and this may be bored, or notched in the edge of two boards, as in the upper detail. Provide the top boards with screws so they can be removed easily for filling the water receptacle. To allow the water supply to be replenished to offset evaporation, bore a  $\frac{1}{2}$ -in. or  $\frac{3}{4}$ -in. hole through one of the cover boards, and use a tin funnel when pouring in the water.

The winged base shown in Fig. 1 is another good kind to make, if you are not particular about preserving the tree's freshness by supplying it with moisture. In its simplest form, the base consists of four boards 6 or 8 in. wide and 20 in. or

(Continued on page 91)

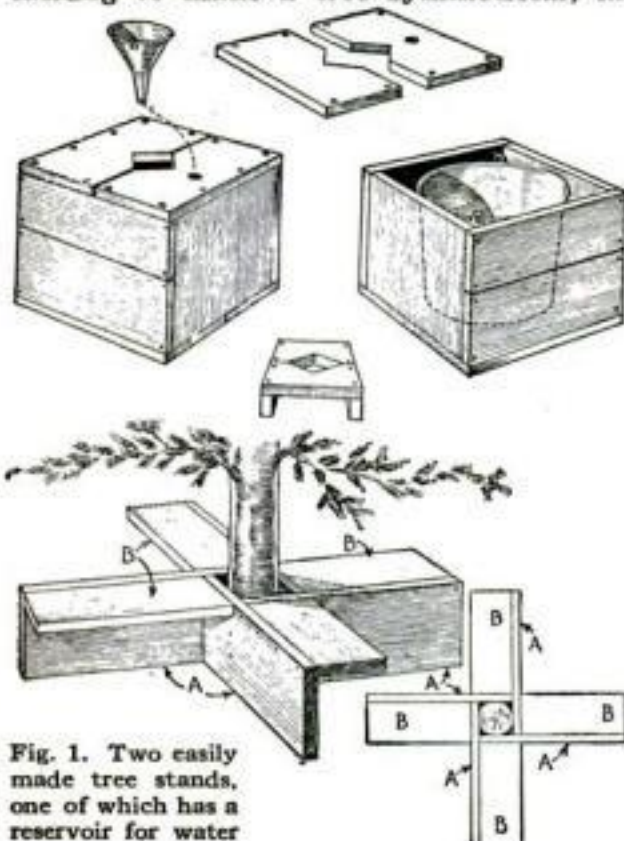


Fig. 1. Two easily made tree stands, one of which has a reservoir for water



# Weatherstrips Cut Coal Bills

## Simple and Inexpensive Ways to Make Doors and Windows Draft Proof

By Lawrence B. Robbins

**Y**OU can save from one to three tons of coal this winter by spending a few Saturday afternoons in applying weatherstrips to the doors and windows of your house.

Large as it may seem, you may rely confidently on effecting such a saving, provided, of course, you live in a section of the country where seven or more tons of coal are required during the winter to heat the average small residence, and if the house is not provided already with storm sash or weather-stripping.

Actual tests have shown that in a 15-mile-an-hour wind a window of average size and ordinary good construction, that is, with no more than the 1/16-in. clearance provided by sash and frame manufacturers, will allow 42 cu. ft. of air leakage a minute when unlocked and 22 cu. ft. when locked. Any common type of weatherstripping will reduce the loss of heat through such a window more than one-half. If one of the better kinds of weatherstripping is used and if, in addition, any cracks around the window-frame are calked with oakum, the saving will be much greater.

For ease of application, cheapness, and general efficiency, the home worker will find the common wood-and-rubber weatherstrips sold at most hardware stores quite satisfactory, but there are many



Shake the upper and lower sash to see whether the sash lock holds the meeting rails together in a snug fit



(At left) If necessary, move the nearer half of the catch inward after plugging the old screw holes



If the lower sash is loose, remove the stops and then refasten them closer to the sash

other varieties, each of which has certain advantages, and these are listed at the end of this article.

The general principle of applying ordinary weatherstrip to windows is to nail or tack it against what is called the "blind stop" outside the upper sash so that it presses against the side stiles and top rail of the sash. The pressure should not be so great that the window cannot be opened readily.

The lower sash usually does not require weatherstripping, provided the inside stop is adjusted to fit snugly against the sash stiles. If the lower

sash is very badly fitting, weatherstrip will have to be placed on the stops inside, the only objection being that the strips are more or less unsightly.

To make a door fit snugly, adjust the strike-plate that engages the lock bolt and shift the wooden door-stops, if necessary; then apply the weatherstrip to the door-stops at the sides and top so as to press firmly against the door when it is closed and locked. Fasten a heavier strip to the bottom of the door on the side where it will not interfere with opening the door.

Other points in regard to weatherstripping are shown graphically in the accompanying illustrations.

The principal types of weatherstrip are as follows:

**Felt.** Sold very cheaply in rolls. Should be at least 1/2 in. wide when applied to inside lower sash of windows; 5/8 in. wide for outside of upper sash, and either 5/8 or 1 in. wide for the bottom of doors. Applied with copper, brass, or galvanized tacks, spaced closely. Renew every year.

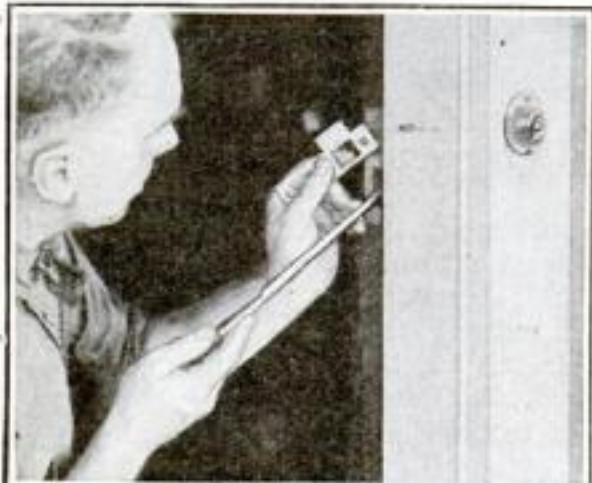
**Flexible Rubber.** Corresponds to felt in treatment, but is more durable. Nails usually furnished.

**Wood and Rubber Molding.** Some varieties have tubular rubber inserts, and others have solid rubber. Sold by the foot, frequently in 7- or 12-ft. lengths. Should be at least 5/8 in. wide for windows, 3/4 or 1 in. for the sides and top of doors, and not less than 1 or 1 1/4 in. for the bottom of doors. Applied with 1-in. brads spaced about 9 in. apart, except at the bottom of doors, where 1-in. round-headed brass screws are preferable to nails.

**Wood and Felt.** Same treatment as wood and rubber molding.

**Zinc and Rubber.** Often called "metallic weatherstrip." Should be at least 1/2 in. wide for windows, 5/8 in. for sides and tops of doors, and 3/4 in. for door bottoms. Applied with brads spaced closely to-

(Continued on page 112)



If an outside door rattles loosely, examine strike plate. Probably it needs to be removed, the socket chiseled out slightly, the holes plugged, and the plate fitted so that it will hold the door tightly shut

(At right) Nailing a wood-and-rubber strip to a door-jamb



If, in an emergency, it is desired to weatherstrip a very loosely fitting door in the cheapest and quickest manner possible, a strip of felt may be tacked against the narrow face of the stop, as shown in the upper view. One of a variety of self-actuating metal weatherstrips for attaching to the bottom of a door is shown in the lower illustration



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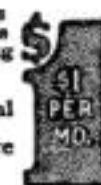
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sewage, purification. Fix-  
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ing. Screwed fittings,  
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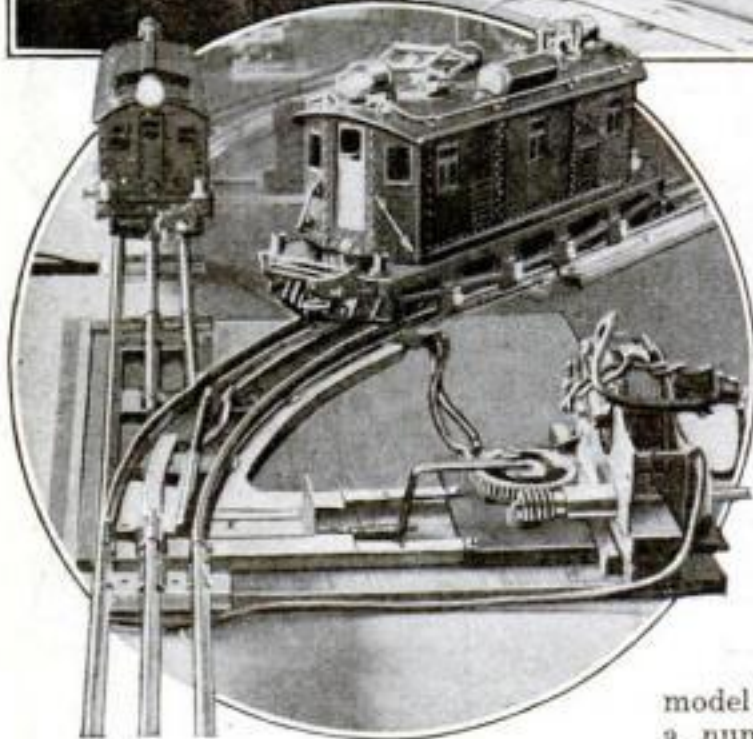
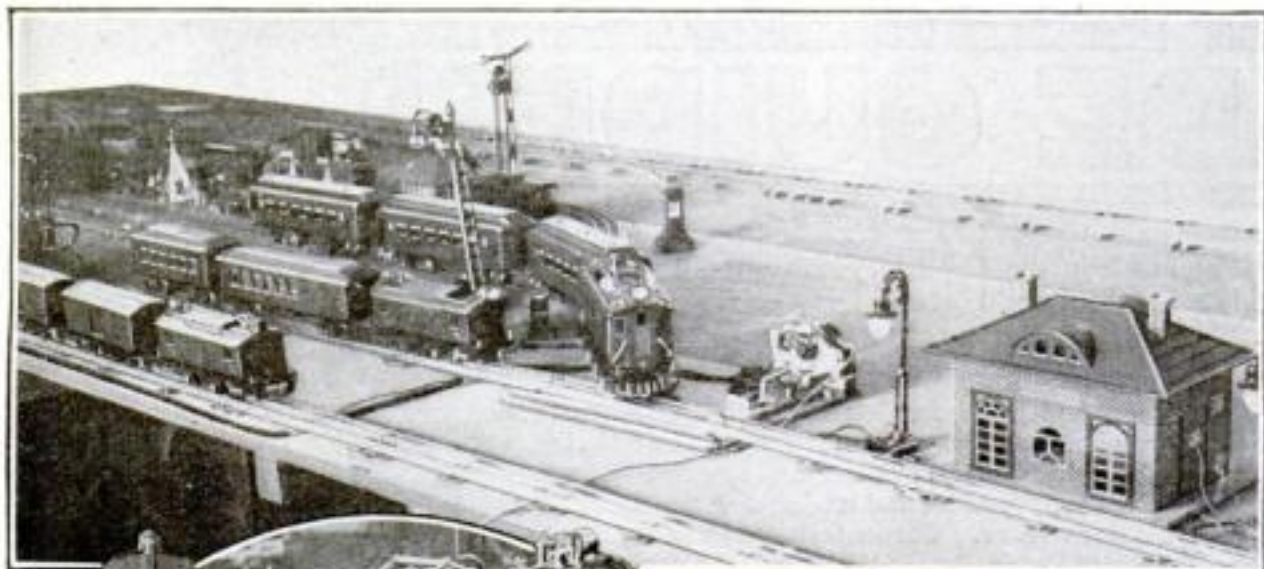
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# Automatic Control for Model Trains

*How to Add Electrically Operated Switches to a Miniature Track System  
—First of Two Articles on Auxiliary Equipment for a Toy Railroad*



By James A. Baker

**A**ROUND Christmastime, when toys are prominent in shop windows, a display of miniature electric railroads always draws a crowd.

Small boys there are a plenty, from the ragged urchin with his nose flattened against the glass up to youngsters in their first long pants. But they are outnumbered more often than not by the men, who are just as fascinated as the children by the realistic locomotives and the long trains of pullmans or freight cars. Perhaps a few of the men glance about somewhat guiltily to see if any of their friends have spotted them, not realizing how many men go in for model railroading quite as enthusiastically as others go in for golf.

After all, a hobby is a hobby, whether it happens to be stamp-collecting or shooting elephants in Africa or model engineering.

Aside from the actual construction of model electric engines, cars and track equipment, much interesting work can be done in developing auxiliary control systems for standard miniature railways.

Of great aid to realistic operation, for instance, is an electrically controlled switch. Sometimes the track layout covers such a large area that it is ex-

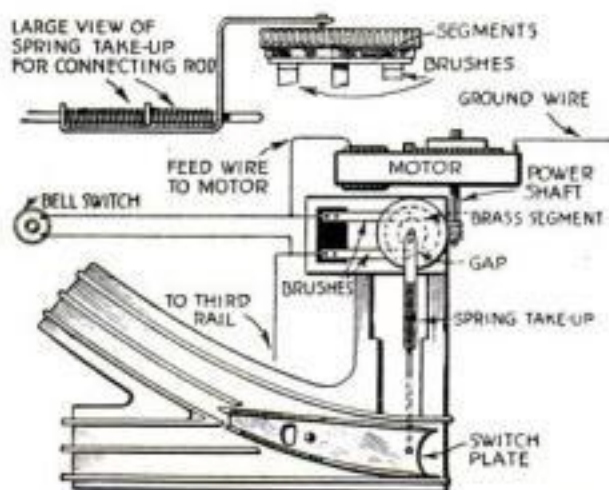
**S**ANTA CLAUS is going to distribute many thousand miniature electric railroads this Christmas. After they have been in operation a while, their eager, energetic little owners—big ones, too—will be seeking new things to do with them. These views offer a suggestion in the way of a simple switch that is controlled electrically

tremely awkward to throw by hand the switches necessary to perform complicated side-tracking. American manufacturers of model railway systems have developed a number of accessories, such as automatic stop signals, block lights, and crossing gates, but none of them seems to offer an electrically operated switch.

The home construction of such a switch is relatively simple. The switch illustrated is now in actual operation on my own track layout and a touch on a button at the central control board throws the switch from open to shut or vice versa. It never fails to work properly.

In order to show the details of construction, I have removed the switchman's small shanty that ordinarily conceals the mechanism.

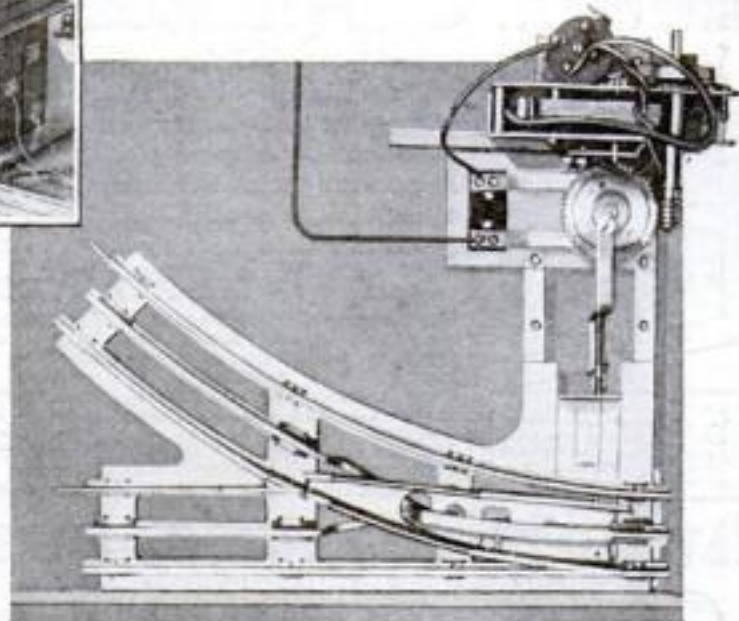
One particularly important feature of this method of control is that it can be



Plan view and wiring diagram of the switch and detail of connecting rod and link

applied with only minor alterations to any of the standard hand-operated switches now on the market.

The first step in remodeling a switch in this way is to take off the hand lever and all of the mechanism that goes with it, including the connecting rod that runs from the switch lever to the bottom of the plate to which the movable sections of



rail are attached. Next, free up the movement of the movable rails so that the switch can be opened or closed by a very light pressure of the finger.

A piece of  $\frac{1}{4}$ -in. sheet steel, 2 by 4 in., is drilled on the center line 1 in. from one end with a No. 3 drill and tapped with  $\frac{1}{4}$ -in. S. A. E. thread. This base plate then is bolted to the sheet-steel framework on which the switch is mounted with 6/32 screws, as shown in the plan view above.

**I**NTO the tapped hole is screwed a standard  $\frac{1}{4}$ -in. S. A. E. bolt, from which the head has been sawed. This bolt serves as an axle for a standard worm wheel of 32 pitch having 52 teeth. The worm wheel and a worm to go with it can be obtained from any large hardware supply dealer or any of the many firms manufacturing standard lines of gear wheels.

On the underneath side of the worm wheel is mounted a disk  $\frac{3}{16}$  in. thick and slightly smaller in diameter than the bottom of the worm-wheel teeth. This disk should be made of any good insulating material, such as hard rubber or bakelite.

The easiest way to fasten the disk to the worm wheel is to drill and tap two holes for 6/32 flat-head screws and countersink the insulation so that the heads of the screws will be at least  $\frac{1}{16}$  in. below the surface. A  $\frac{1}{4}$ -in. hole will have to be drilled in the disk so that it will fit over the shaft.

Now look at the drawing at the left. You

(Continued on page 115)

TURN TO PAGE 76 FOR THE CONTINUATION OF THE HOME WORKSHOP DEPARTMENT



## Ozarka Senior Console—\$197.50 East of Rockies

*Complete with Tubes, Batteries and Speaker*



# A Good Wife and a Good Radio Assures Lasting Satisfaction

A LITTLE more time, a little more care in making the selection in the first place generally tends to more lasting satisfaction.

Out of every 100 Ozarka's sold in 1922 only eight are not today in the hands of the original owners—this does not include 17 out of each 100 who have purchased later Ozarka models in newer type cabinets. If there is a single Ozarka that is not in active service today, we have never heard of it.

Without the Ozarka Service in charge of direct factory trained representatives, such a record would not be possible. Ozarka service can be had today in almost every country. Purchasers in South Africa, Alaska, Sweden, Newfoundland, New Zealand, and Japan all receive the same practical service as those in Canada, United States, Mexico and Cuba. Whenever you find the sign of the Ozarka long distance goose, you'll find a man who knows Ozarka instruments perfectly.

If such service added more to your cost price it might be a matter to consider, but it doesn't. Quality for quality you'll find Ozarka prices lower—four tube Ozarka's with built-in loud

speakers retail for \$58.00—five tube with built-in speaker \$64.00, up to solid walnut console design, \$160.50.

Our nearest representative will gladly set up an Ozarka in your home, without any obligation whatever. He won't tell you what it will do—he will let you do all the tuning. With the Ozarka you must satisfy yourself, as to distance, tone, volume, ease of tuning and selectivity.

More than this you will be very agreeably surprised at Ozarka prices—selling as we do, thru our own direct factory representatives, our selling expense is very low—we give Ozarka purchasers the benefit of it.

Where is there a value to compare with the one shown above—solid walnut cabinet (no walnut finish or veneer), imported English loudspeaker of a marvelous tone, five tube instrument with 75 ampere Exide storage battery, 90 volts of Eveready "B" battery, 5 tubes, aerial equipment all erected and the price is only \$197.50.

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In a great many counties we have the man we want. He is rapidly building up a permanent and profitable business of his own because he has an instrument that will more than meet all competition. More than this, he is trained to back up his sales with the kind of service that counts.

Many well established Ozarka representatives started by giving us only their spare time—their evenings. If your county is open you can do the same.

The investment in cash is very small. The investment in time necessary for study is considerable. It requires patience, but the results have enabled many men to get out of the salary and time clock class.

Any previous sales experience is helpful but not necessary. We can and will teach you how to sell.

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This book is entirely too expensive to be sent out on postal card requests. It will be sent FREE to any man who mails the coupon below and who is really anxious to improve his condition. Tell us about yourself—ask for Ozarka Plan No. 100 and don't fail to give the name of your county.

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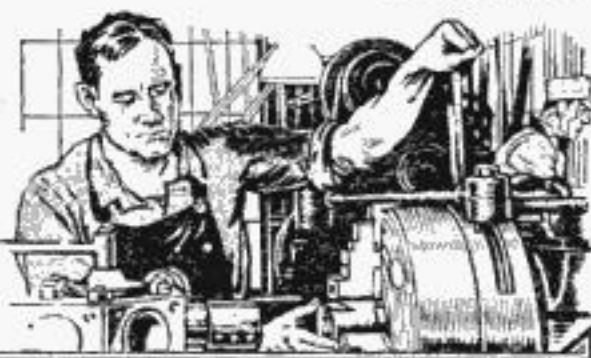
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# Better Shop Methods

*How Expert Mechanics Save Time and Labor*



## Old Bill Rejuvenates an Engine

*How to Replace Large Bearing Shells—Hints on Fitting Keys*

By James Ellis

*Machine-Shop Superintendent*

OLD BILL and Bob Laten stood looking at two steel castings that had just been delivered to the shop.

"These bearing shells are to replace some that have been running in the engine at Jenkins' place for 20 years," said Old Bill, "and if we do good work on these, we can point to them with pride for another 20 years."

"That is a long time for a job to last," Bob remarked. "We shall have forgotten about it by then."

"We may have," Old Bill was quick to reply, "but the customer will remember."

When the castings had been planed several days later, Old Bill went out with them to the engine. It was a cross-compound engine with a shaft about 15 in. in diameter. The crankshaft had been raised and blocked up out of the way.

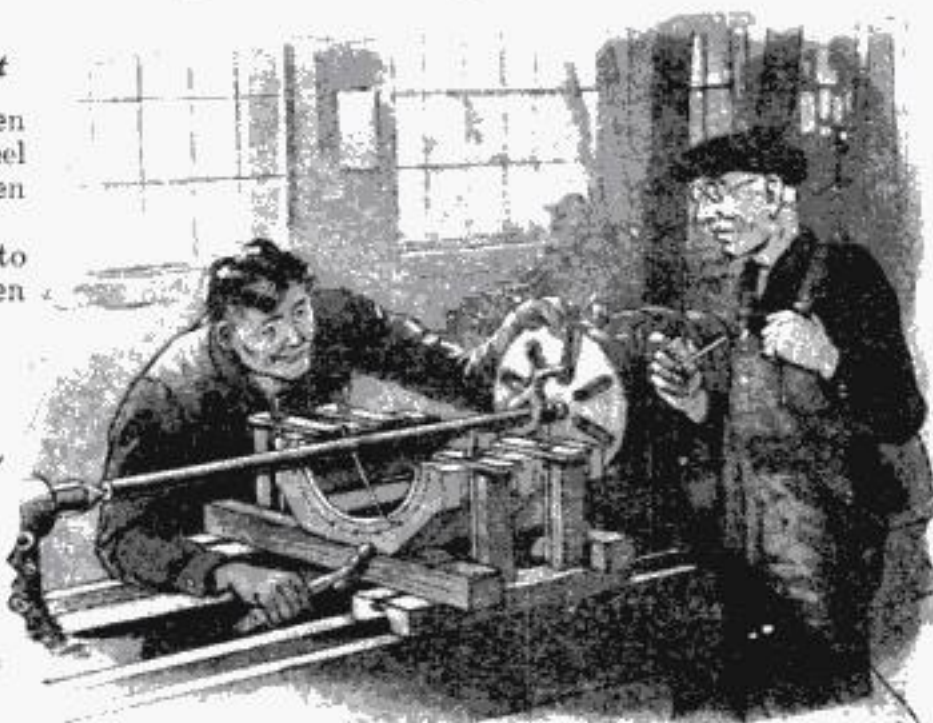
While the bottom shells were being put into their places, Old Bill checked up the setting of two steel lines that had been run through the cylinders and prepared to put another line through the bearings. He adjusted the third line so that it was at right angles to the other lines and in the center of the bearings.

AS SOON as he was satisfied with the location of the line, he chalked the ends of the castings. With hermaphrodite calipers touching the wire lightly, he marked points on the castings.

"Put fine center-punch marks on these points, so that we shall have no trouble in finding them," he told Laten. "I have laid out the circle on both ends so that when we get back to the shop we shall be able to set up the castings in a lathe with the axis of the lathe in just the same place as this wire is in now."

The following day Old Bill directed the tinning of the shells for babbitting. It was not easy to get a good film of solder on the steel castings, but he insisted that his men use plenty of acid and even more patience until there was a perfect coating of solder to unite the babbit to the steel. The forms for the babbit were clamped in place and the metal poured while the castings were still warm.

"Never think of using anything



While Old Bill looked on, Laten set up one of the bottom bearing shells in a lathe with the aid of a bent wire held in the boring bar

but the best babbit on this kind of a job," Old Bill commented, as he watched \$100 worth of babbit going into place.

Old Bill would have liked to follow the job along so that he could be absolutely certain every little detail was perfect, but there were other things in the shop to claim a part of his time. One of them was a gear that had been sent in to be made tight on its shaft. This shaft was about 5 in. in diameter, and the gear repeatedly worked loose. It could not be pressed on, for the wheel was within the frame of the machine of which it was a part, and the whole had to be assembled before the gear could be put in place. Old Bill had a new key forged and the keyseats in both the shaft and the hub trued up. A machinist was fitting the key.

"Take plenty of time on the fitting," Old Bill said, when he came to the bench

where the key was being fitted. "This gear has given no end of trouble and we want to be the ones who make it right."

"I have the key fitted on the sides now," the machinist replied.

"But you still have the really important part to do," Old Bill returned. "You will have to drive it in and out, and file off the high places until it takes a perfect bearing from one end to the other on both the top and the bottom when it is finally driven home. Then we shall be sure that this gear will not come loose again. Do not make the mistake of filing off too much at a time."

The machinist smiled at this admonition. He had fitted keys for Old Bill before, and he knew just how Old Bill wanted them.

By this time Bob Laten was setting up the first of the bearing shells to be bored. He had timbers laid across the carriage of his lathe and was fitting shims under the casting to bring it up to the correct elevation. He had a bent wire in the boring bar, and was revolving the bar to see how nearly right the setting was.

"WE HAVE done well so far, Bob," Old Bill commented, "and do not want to slight this part of the work. If you get the bottom shells bored out just right, there will not be much scraping to do, but if you get a little bit off, you may have to scrape a couple of days more to get a good bearing."

"I don't like to scrape," Laten replied, "so I am going to get them so there will be next to none. I made gages for the diameters when we were out there the other day."

Old Bill was pleased. A twinkle flitted through his eyes. He liked the calm assurance Laten possessed. And he was thinking of a day about 20 years before when he had done a similar job himself. It had been on this same engine. He felt happy that, the customer had remembered him but not especially surprised, because he knew that good and faithful work is not quickly forgotten.

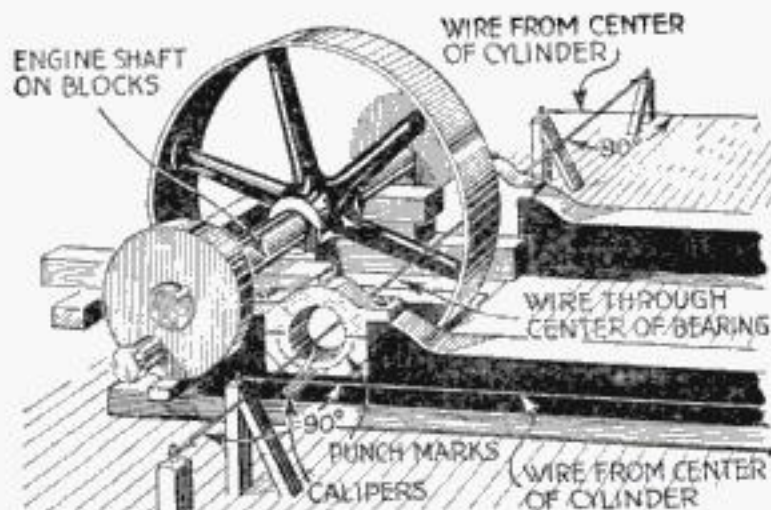


Diagram showing how Old Bill used three guide wires as an aid in laying off the shells accurately

MANY time-saving shop ideas are contained in the continuation of the Better Shop Methods Department, which you will find on pages 124 to 133.





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## The Home Workshop

### Unique Yule-Time Decorations for Over the Mantelshelf

By John Boyd

**W**OULD you like to introduce a new note into your holiday decorations this year? It can be done by turning the space above the living-room mantel into a picture that symbolizes the spirit of Christmas.

With the commonest materials and a few cheap commercial ornaments, you can construct a scene that under the illumination of electric lights will seem quite magical in its brilliance and beauty.

Framed by crimson and gold draperies, the mantelshelf becomes a stage. In the center, significant of the Christian origin of the day, is a miniature representation of the Manger. Surrounding it are picturesque houses blanketed with snow, tiny trees sparkling with icicles, and a landscape of snow-covered hills that seems to stretch away toward a distant horizon, above which, floating in the clouds, is an angel choir.

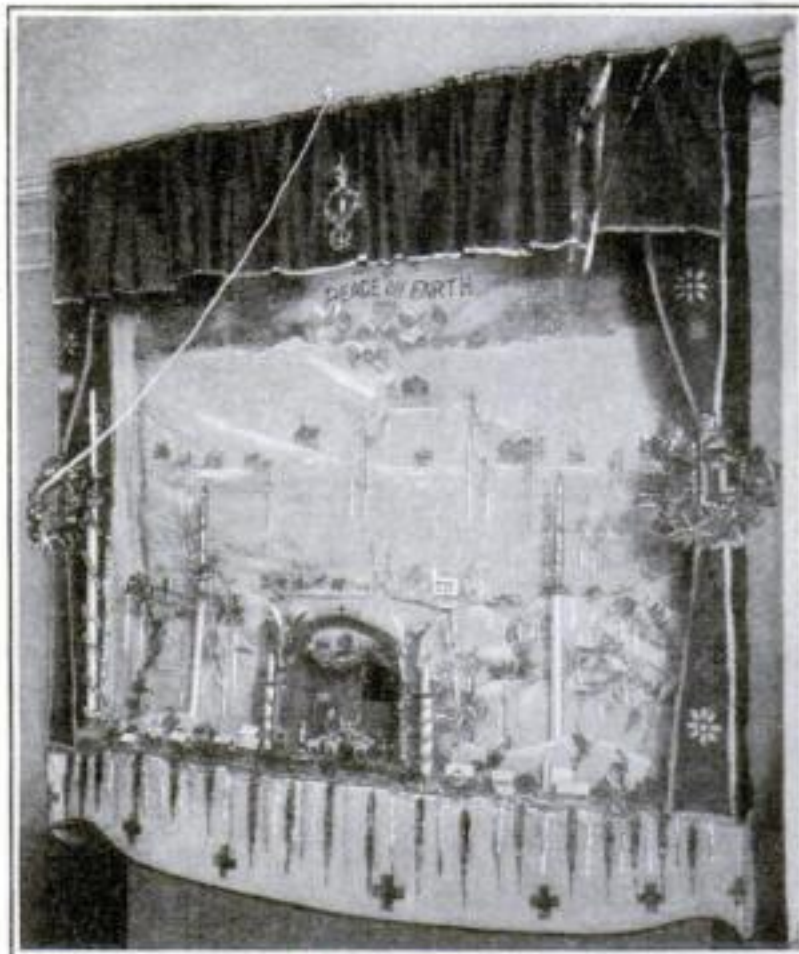
To set this stage is more a matter of patience and ingenuity than artistic skill. First build a frame of  $\frac{1}{2}$  by 1 in. wooden strips to reach from the mantel to the ceiling below the cornice. Nail two intermediate vertical strips and four corner braces about 1 ft. long to the frame to strengthen it.

Tack some muslin or canvas loosely to the frame. Size this with a half cupful of pulverized glue dissolved in a quart of boiling water. When dry, the size will stiffen the muslin in irregular ridges. Dab some patches of plaster of Paris and water on the muslin to form little hills.

Mix 2 lbs. of commercial kalsomine in a quart of boiling water, allow the mixture to cool and apply freely to the muslin. While still wet, make the sky with some dry cobalt blue (five cents' worth) mixed with a little of the glue size. Blend the blue softly into the wet kalsomine to make clouds. Sprinkle some artificial snow on the wet kalsomine all over the muslin below the horizon line.

**A**FTER the kalsomine has dried, paint little houses on the skyline with dry umber (five cents' worth) mixed with the glue size. Dab little spots of yellow and bright red paint on the houses for illuminated windows and put a touch of kalsomine on the roofs.

Paint larger houses and a few churches on the muslin, as you work down toward the mantel. You can glue some flat wooden toy houses in the ridges of the muslin, as well as small sheep, horses, cows, and a shepherd boy.



Although the draperies are merely crape paper, the snow kalsomine, and the candle-holders mailing tubes, this scene is one of dazzling brilliance when illuminated.

Glue stiff hairpins to five or six winged paper angels and stick them in the sky, just above the skyline. Above these paste a few paper angels cut from Christmas postcards. Higher still should be a white cloud, on which you may paint faintly with red and yellow, "Peace on Earth."

**N**EXT make the mantel cover of muslin or oilcloth, letting it hang down about 1 ft. Kalsomine it, sprinkle with the snow and decorate the front as you please, perhaps using glass icicles and crosses painted with gold bronze.

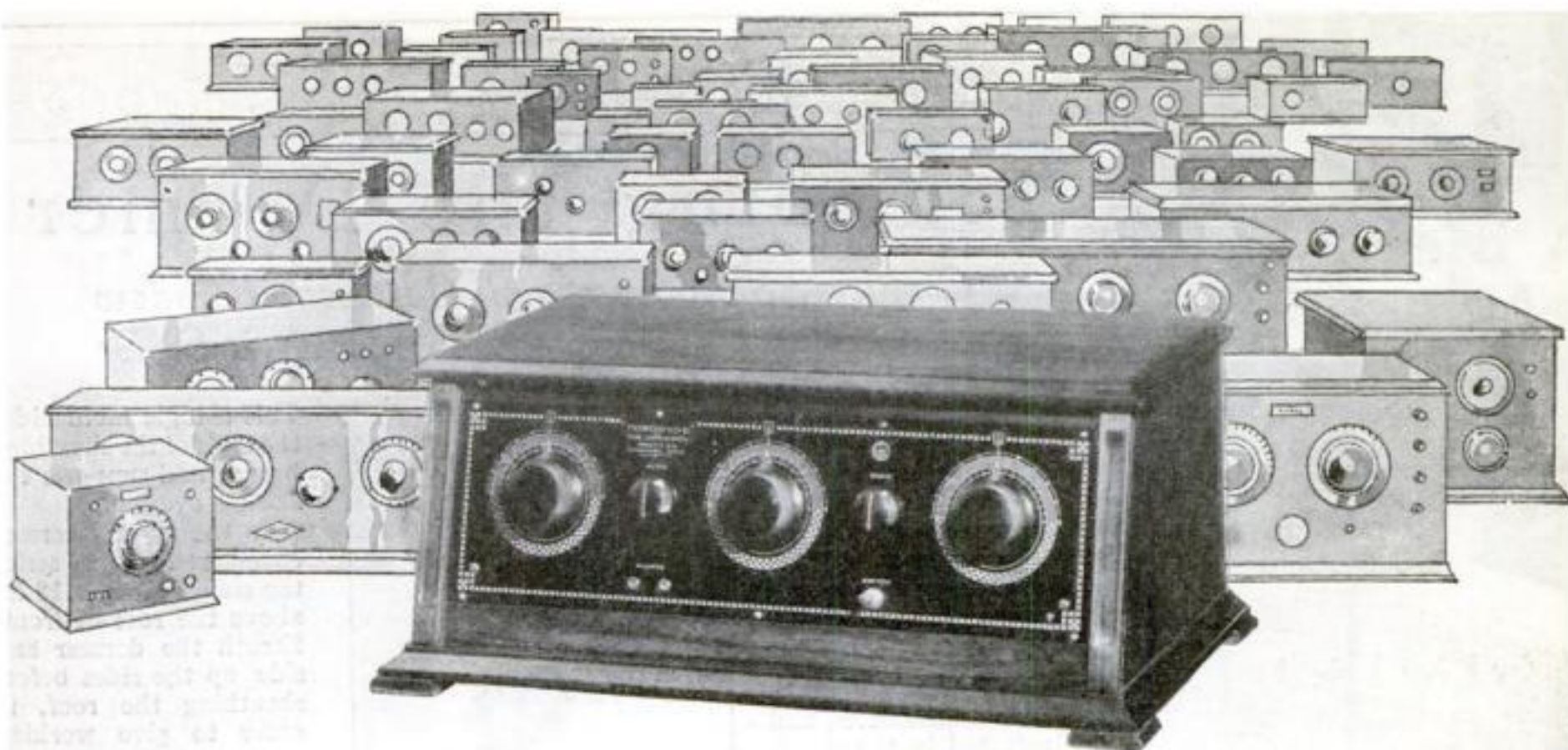
Make the crib from a small wooden or stiff pasteboard box 12 in. square and 8 in. deep. Slant the roof. Cut a window opening 3 in. square in the rear of the box at the center and paste red crape paper over it. Tack a piece of cardboard in the left corner for the manger. Paint the box with umber and size. Kalsomine the roof, letting some of the fluid run over the sides, and sprinkle with snow. Arrange the figures inside as you please, but do not have the largest ones more than 3 in. high.

Now set the canvas on the mantel and nail it to the wall with eight 1-in. wire nails, one at each corner and one in the center of the top, bottom, and sides. These small nails will hold the frame securely and yet will not deface the wall.

Place the crib in the center of the mantel against the canvas. From large, stiff pasteboard boxes cut two rows of hills for either side of the crib, the larger

(Continued on page 86)





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Let me know where I can make a comparative test of the Torodyne. This puts me under no obligation.

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# The Home Workshop

## Finishing the Dormer

*Cornices, Shingling, and Casement-Window Frames—Fourth Article in the Attic Series*

By Edwin M. Love

IF YOU will observe the cornices or gable overhangs in your neighborhood, you will see that there are many varieties. Most of them, however, are modifications of the construction described last month, in Part 3 of this series, and illustrated in the drawings below and in the photograph on page 118.

By means of blocks nailed between the barge board (or fascia) and the gable, a plancher can be used to box in the roof projection. A bed mold then is nailed against the siding and plancher to finish the joint.

Whatever the construction, a molding, which may be anything from a simple 1 by 2 in. strip to a heavy, ornately profiled band, must be nailed flush with the sheathing on the face of the barge boards.



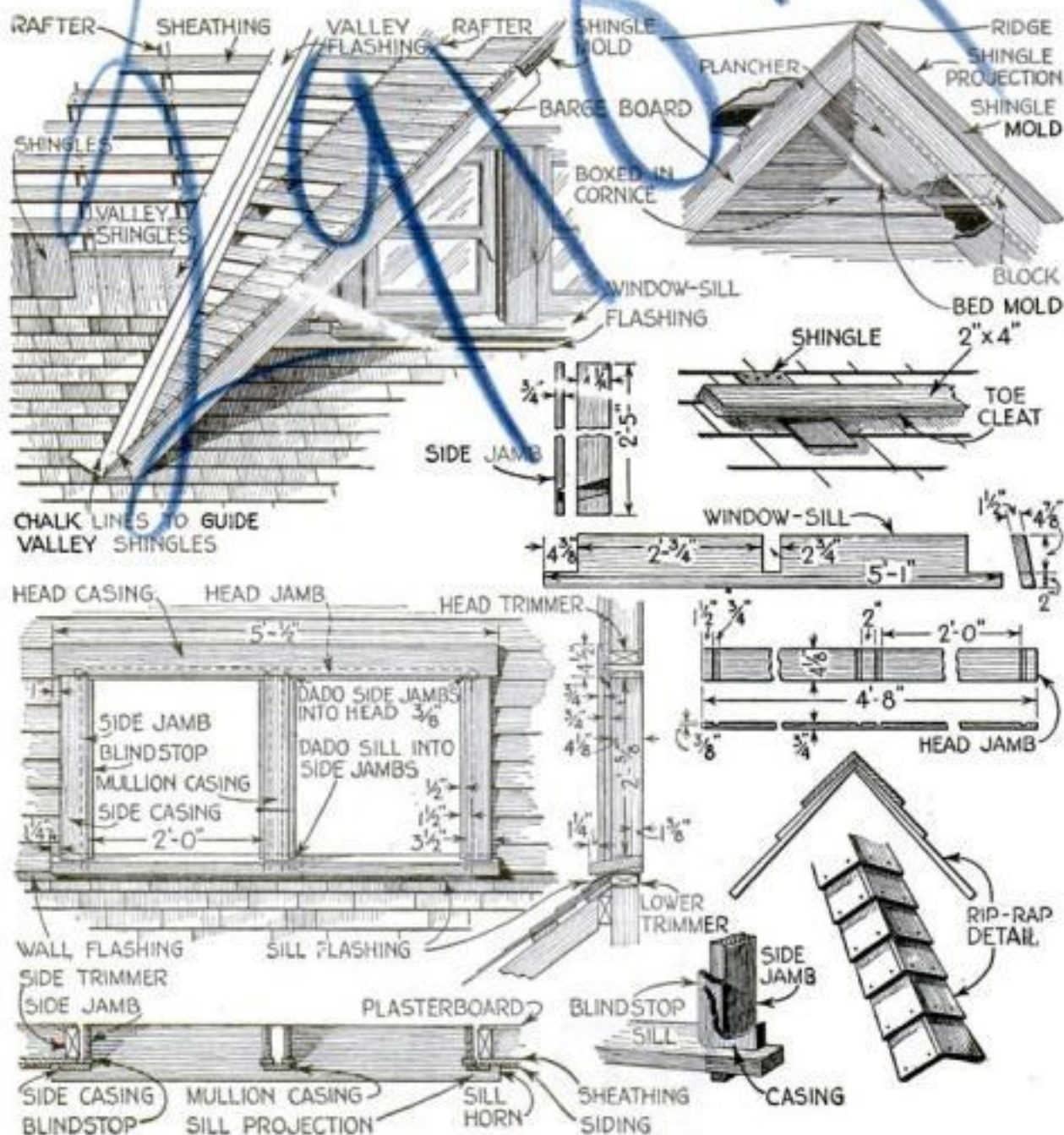
This shingle mold hides the ends of the sheathing boards and supports the shingle overhang.

In the typical dormer considered in this series the side walls rise 18 in. above the roof in front. Sheath the dormer and side up the sides before sheathing the roof, in order to give working room; and since the valley is continued from the dormer ridge to the intersection of the main roof with the barge boards, the old shingles may be patched out to the sides

without reference to flashing.

From the intersection between the dormer roof above the plate and the main roof, the shingles must be "broken back" and sheathing laid up on the dormer overhang, keeping the valley line straight. A 1 by 4 in. strip nailed on the main roof

(Continued on page 118)



The general construction of a shingled dormer roof, the method of making a simple cornice, toe cleat for the shingler, how to lay the ridge shingles, and details of the casement-window frame

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And now—you can obtain this remarkable Hammarlund-Roberts Receiver for LESS than the price of any factory made five-tube receiver on the market of anywhere near equal quality.

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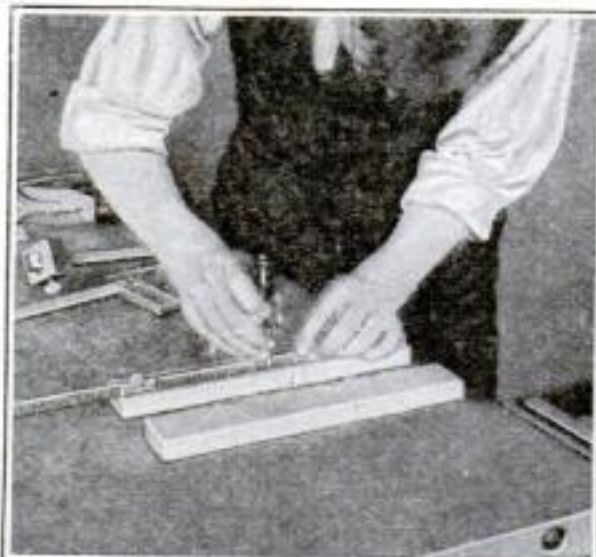
## The Home Workshop

### How to Fit a Cross-Lap Joint

*Useful for Framing and Furniture Construction*

By Emanuel E. Ericson, *Noted Manual-Training Authority*

**Y**OU can solve your woodworking problems with much greater ease if you are familiar with the methods pictured in this series of articles, which began last April.  
—THE EDITOR.



**1** Square and face-mark the pieces and find the middle point of each or the middle point of the joint, if it is not to be central. Through each point square a line with your knife



**2** Lay one piece on the other as shown above, guiding the upper one against a square. Then remove the square and mark points at each side for the width



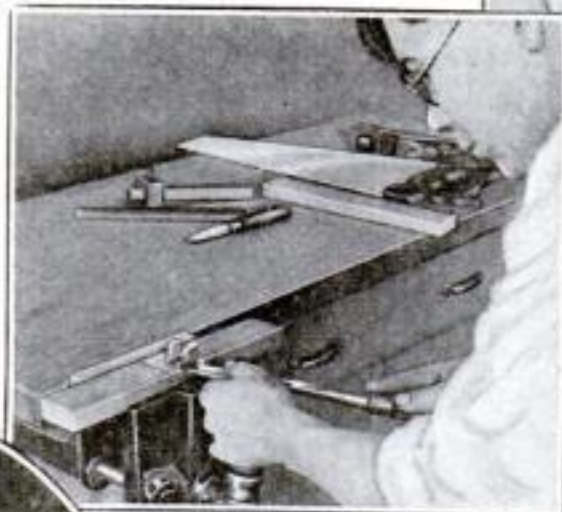
**3** (Above) Square a line across the wood at the points you have just marked and also halfway across each edge. Both this step and that shown in Fig. 2 must be followed out on both of the pieces



**4** Set your marking gage for approximately one-half the thickness of the wood and mark the edges of both pieces, working from the face side



**5** (Above) Either use a backsaw for cutting the joint, first chiseling a V-shaped groove to start the blade as recommended last month, or clamp a piece of wood to the stock as a guide and cut snugly against it with a fine hand-saw. An expert woodworker does not need this aid, as he can run a fine saw against a knife line by eye with great precision. The saw cut must be accurate so that no trimming will have to be done. Make a cut or two in the waste wood to aid in chiseling



**6** Hold the work with a waste piece behind it as shown above and use as wide a chisel as possible

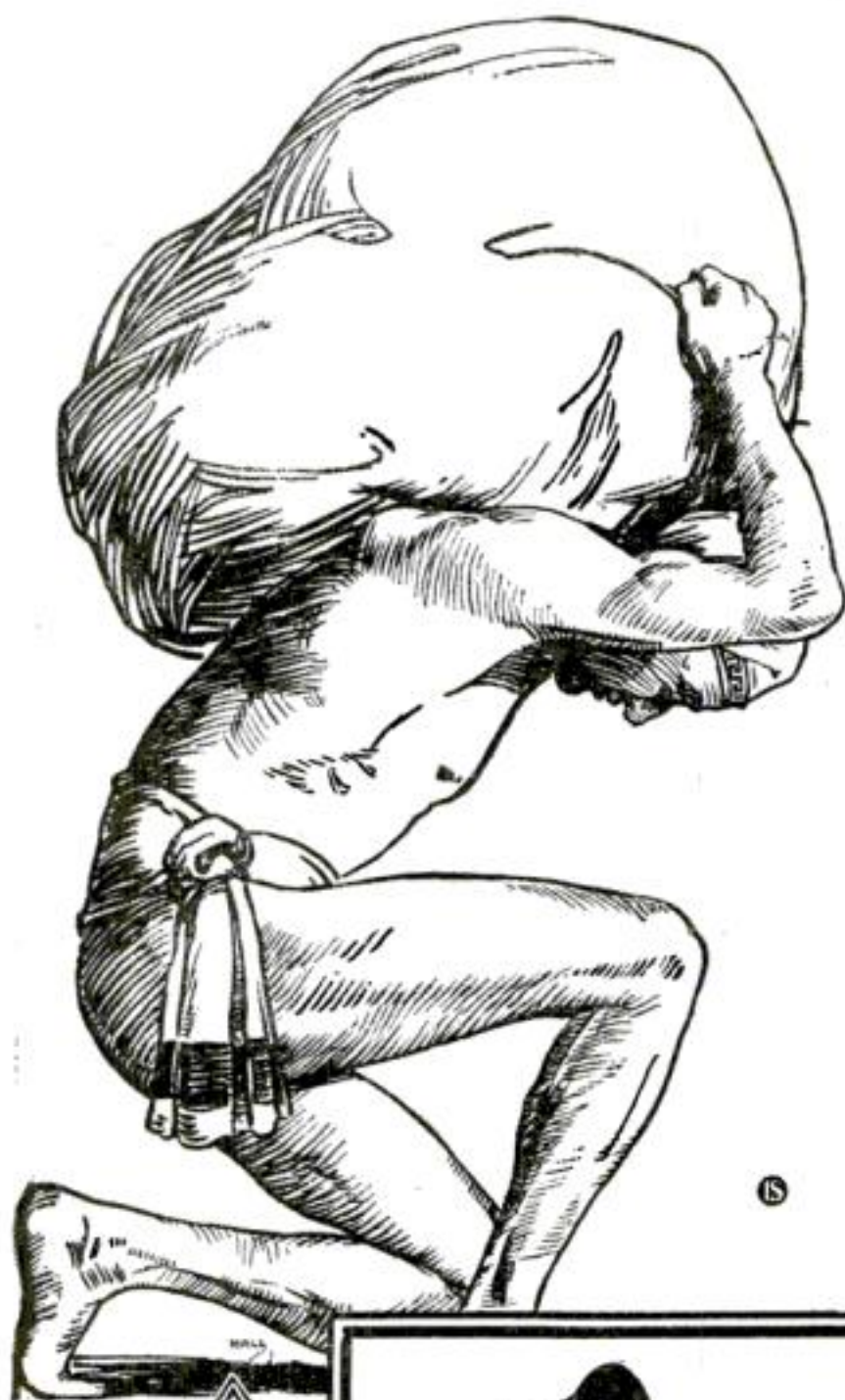


**7** The finished joint (at left) should go together without forcing. The joint may be laid out in other ways, but this is a safe, easy method for beginners



# VOLUME

## THE OBEDIENT SLAVE TO YOUR DESIRES



The stirring, martial music of a band—the soft, mellow harmony of a violin—the pure, sweet notes of a human voice, away off in the distance, dimmed by thousands of miles, come in on APEX Receiving Sets at the very flood-tide of volume.

The beauty of design and handsome, flawless finish of APEX Receiving Sets are as alluring as their perfection of operation.

An inspection of APEX Quality Apparatus will be sufficient to convince you of their super-excellence. Only a dependable merchant is given the APEX dealer franchise. *Your* APEX dealer will gladly make a personal demonstration of APEX Quality Radio Apparatus.

*Upon request, we will gladly mail descriptive folder.*

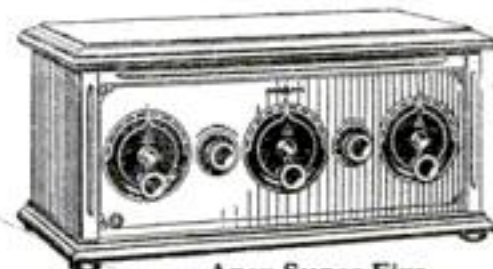
**APEX ELECTRIC MFG. CO.**  
1410 W. 59th St., Dept. 1203  
CHICAGO



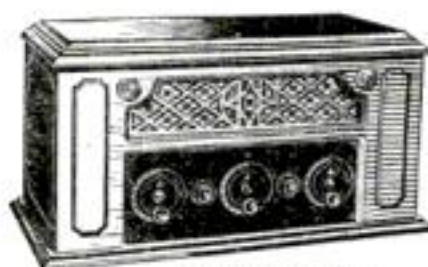
Apex  
Entertainer  
Price \$22.50



Apex Baby  
Grand Console  
Price \$225



Apex Super Five  
Price \$95—  
without accessories



Apex De Luxe  
Price \$135



Apex Console  
Entertainer,  
Price \$27.50



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Prices West of Rockies Slightly Higher. Canadian Prices Approximately 40% Higher.





## No. 32 Radio Plier

Pexto Radio Pliers are drop forged steel, full polished and will form accurately the terminals or loops on Radio Wire and Bus-bar. They are also equipped with wire cutter.

On the No. 32 Plier one jaw has two diameters for forming loops for Nos. 6 and 8 screws and on the No. 34 Plier one jaw has four diameters for forming loops for Nos. 4, 6, 8 and 10 screws.

Write for booklet on Worth While Tools for Radio Work.

Pexto Tools are carried by practically all progressive dealers.

**The Peck, Stow & Wilcox Co.**  
Southington, Conn., U. S. A

**PEXTO**

*Worth While*  
**TOOLS**

# The Home Workshop

## Special Uses for Wallboard in Beautifying Your Home

FOR many repair and remodeling jobs about the home, fiber wallboard is a thoroughly satisfactory material, especially as it is flexible enough to be bent around curves without breaking. The typical jobs described in this article illustrate ideas underlying the many uses of wallboard.

Because of the hard service to which they are put, laundry porches, bathrooms, and kitchens show wear and tear more quickly than other rooms in the house. The action of steam and water disfigures the plaster, especially on the walls. In such rooms the addition of a wainscot to cover defective plaster will repay amply the expense and effort incident to its building.

Figures 1 and 2 illustrate the use of tile wallboard in a bathroom. This material is embossed in patterns of square or rectangular tiles, and when properly applied and painted or enameled makes a creditable imitation of ceramic tile at a small fraction of the cost of the latter. Since it

is obtainable in widths of 4 ft. and lengths up to 12 ft., in the average room the wainscot can be applied in one piece for each wall. Joint strips are necessary only in the corners.

If the plaster is fairly straight, apply the board over it. Remove broken and

(Continued on page 112)

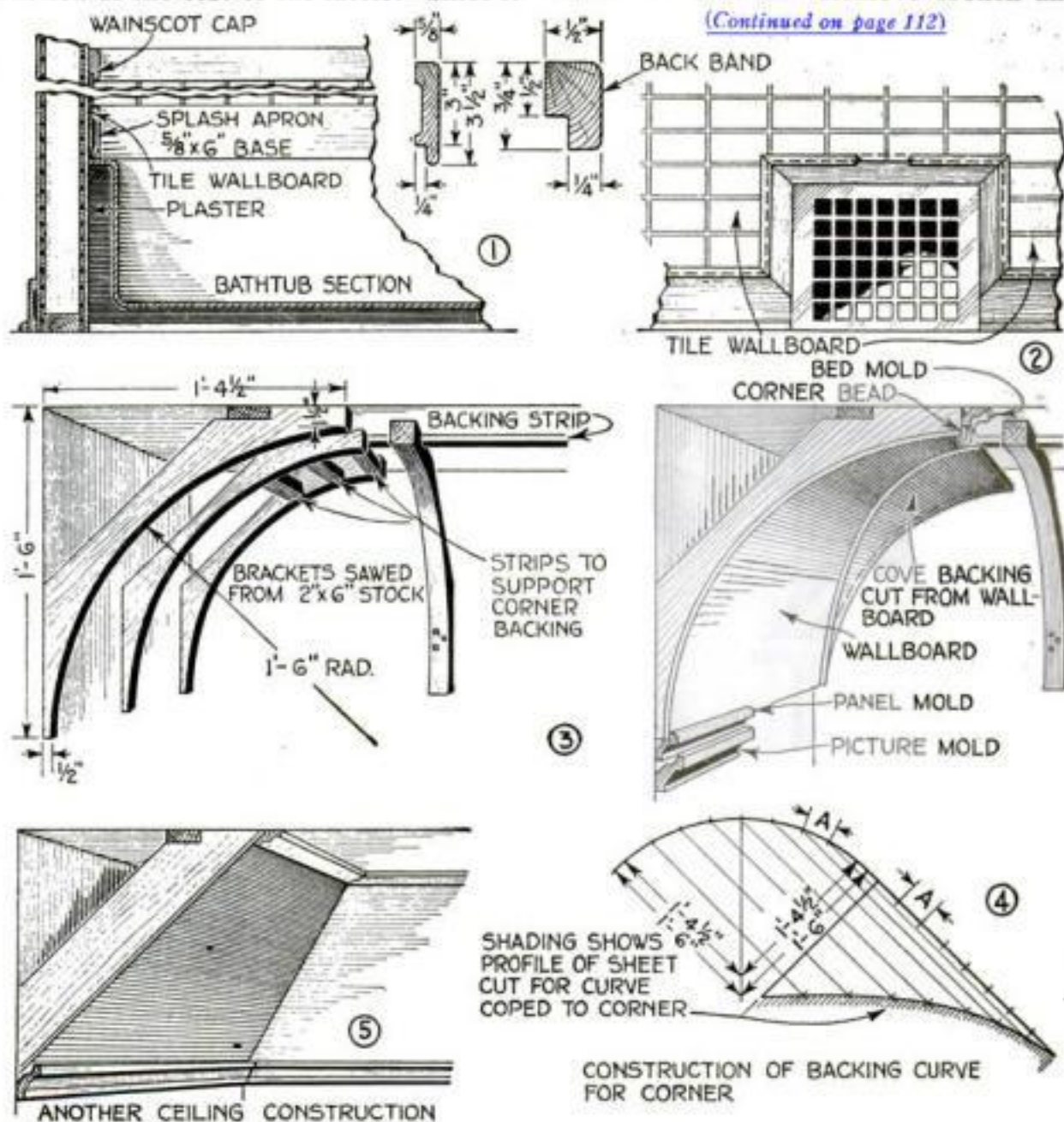


Fig. 1. How to waterproof wallboard around the bathtub. Fig. 2. Fitting wallboard around a register. Fig. 3. A ceiling cove. Fig. 4. Layout of corner backing. Fig. 5. A "chapel" ceiling





The Mark of  
quality whether  
you buy or build!



## Manufacturers know by careful testing what fans have learned from experience

*A list of some of the  
prominent radio manu-  
facturers using C-H  
products*

Acme Apparatus Co.  
American Bosch Magneto Co.  
Astral Radio Corporation  
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Corporation  
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The Keyport Laboratories  
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Wm. J. Murdock  
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R. B. Radio Co.  
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Signal Electric Co.  
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Simplex Radio Co.  
R. E. Thompson Co., Inc.  
J. S. Timmons  
Workrite Mfg. Co.  
Zenith Radio Co.

**Y**OUR new radio set can have C-H quality *whether you buy or build*. Today, reliable dealers everywhere carry C-H radio parts because fans have learned by experience to demand this trademark that insures proper design—highest quality at lowest cost.

But most of these dealers also sell radio sets and accessories that incorporate this same high C-H quality. Radio manufacturers have learned by careful testing what fans already know from experience—the economy of good parts.

Whether you buy or build—the C-H trade-mark on the parts of your radio set is a guarantee of satisfaction.

**THE CUTLER-HAMMER MFG. COMPANY**

*Member Radio Section, Associated Manufacturers  
of Electrical Supplies*

MILWAUKEE, WISCONSIN



**The New C-H UX Socket**

for the new UX tubes. Same C-H one piece, silver plated, double grip contacts as in standard socket. Heat proof Thermoplas body — terminals cannot loosen under heat of soldering iron.



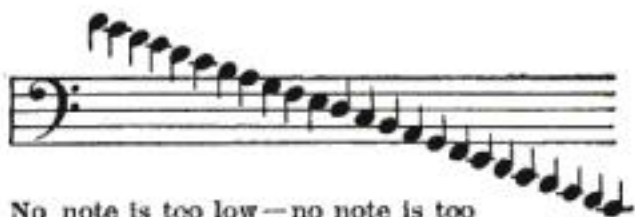
**The Perfected C-H Rheostat**

Designed to radio engineers' specifications. Revolving drum type with one hole mounting. All spring tensions adjusted at factory and undisturbed by mounting. Instrument cannot turn on panel. Very small size — less than 3/4 inch back of panel and narrower than standard socket. Operation smooth and quiet. 6 ohms, 15 ohms, and 30 ohms — perfect control for all tubes and their combinations.

# CUTLER-HAMMER

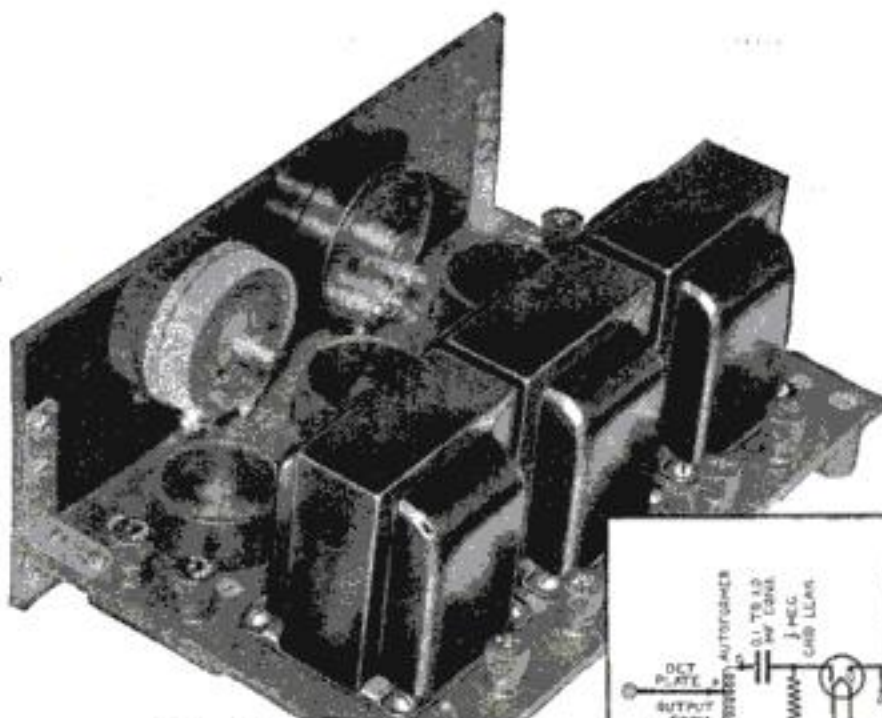
*Radio Parts for Performance*





No note is too low—no note is too high—to be fully amplified by Thordarson Autoformers. Autoformers are all frequency amplifiers—they amplify with even magnitude ALL notes within range of the human ear. Developed, perfected and built only by Thordarson.

*A Thordarson Autoformer Amplifier built in accordance with instructions and diagrams furnished with each instrument.*



# free!

Send for our new interesting bulletins on Autoformer amplification. They contain hook-ups and complete directions.

## Autoformer Amplification Amazes Vast Crowds

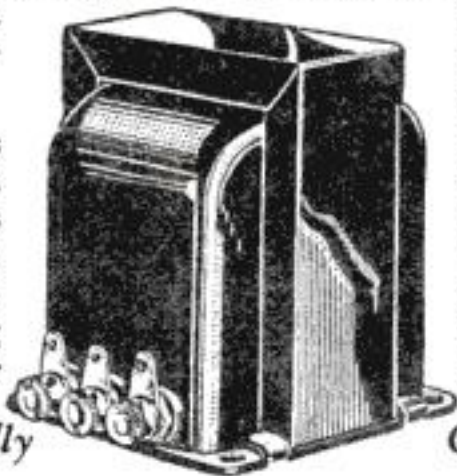
*Used at Radio World's Fair, New York City, to Amplify Programs and Announcements Broadcast by Loud Speakers Throughout the Great Halls*

Tens of thousands of radio enthusiasts were completely won to Autoformer amplification during the Radio World's Fair in New York. The Thordarson Booth was besieged by fans, amazed and delighted over this latest Thordarson achievement. It was hailed on all sides as the outstanding development of the year in amplification. "What is it?" "How may I use it with my set?" Such questions were continually repeated.

Our answer was this: As the world's oldest and largest exclusive makers of transformers, we have led for years in broadening their amplifying range. In the Autoformer

we have finally developed an all-frequency amplifier—a *new* instrument capable of fully amplifying *all* notes audible to the human ear. Thus the deepest notes of the grand organ, bass viol, tuba, English horn, etc., at last are brought out as clearly as those in the middle and upper registers of the musical scale. Improved long distance reception and better volume control are further advantages.

Autoformer amplification is expressly for those who seek the finest reproduction of programs to be had. May be used with any set in place of present amplifying transformer hook-up. Autoformers are \$5 each.



Unconditionally

Guaranteed

# THORDARSON

## Autoformer

Trade Mark Reg.

All Frequency Amplifier

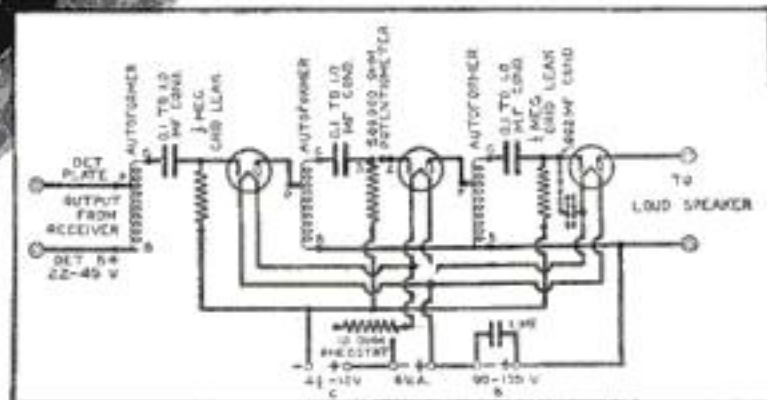
### Other Thordarson Transformers

Thordarson Super Audio Frequency Transformers are to be had in either the sub-panel or top mounting type. Sub-panel type permits neater assembly, shorter leads and concealed wiring—as in factory sets. Three ratios: 2-1, \$5; 3½-1, \$4; 6-1, \$4.50.

Thordarson Power Amplifying Transformers, \$13 the pair. Thordarson Interstage Power Amplifying Transformers, \$8. All Thordarson products are unconditionally guaranteed. Shipped direct upon receipt of price, if dealer cannot supply.



**THORDARSON ELECTRIC MANUFACTURING CO.**  
Transformer specialists since 1895  
**WORLD'S OLDEST AND LARGEST EXCLUSIVE TRANSFORMER MAKERS**  
**Chicago, U.S.A.**



### How Autoformer Amplification is praised by its users

Dunkirk, N. Y., August 5, 1925.

This is to congratulate the Thordarson Co. on their achievement in producing such a perfect piece of apparatus as your Autoformer which I embodied in a new hook-up I have just completed—tuned regenerative R. F. 2 stages, soft detector and 3 Autoformers. I wish to advise that it is without parallel, exception or any comparison whatsoever, the most perfect performer I have ever seen, heard, tested or built—and I have built some pretty good ones.

Reproduction is absolutely faultless and perfect throughout the entire register—each and every note from the deepest bass to the highest treble is perfect and uniformly amplified. Sunday night I had Godfrey Ludlow on his 225 year old Stradivarius (from WJZ) absolutely perfect although it was a pretty "rotten" night. It was some treat. To-night (one of the poorest for some time) I pulled in everything east of the Rockies, that was on the air and I pulled in enough music to overcome the static to a great extent. Everything on Speaker.

She's a good D.X. getter and as for volume, has all that the windows will stand—and with all this volume does not distort any. It makes a beautiful outdoor program distributor. You can hear it plainly and perfectly for two or three blocks (at night).

Very truly yours,  
John Player.

**ZENITH**  
**KENNEDY**  
**Radiodyne**  
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**Valley**  
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**KUSTOMBILT** and many others

Also choice of the  
MacMillan  
Arctic  
Expedition

use Thordarson Super Amplifying Transformers. Leading set builders use more Thordarsons than all competitive transformers combined.



## The Home Workshop

### Still Time to Build Furniture for Christmas Gifts

**B**Y ACTING quickly you can manage, even at this comparatively late date, to build a piece of furniture or a radio set for Christmas. There will be no time for guesswork or experimenting, however, so it will pay you to make use of one of the blueprints listed below as a guide to style, material, and construction.

Especially noteworthy for ease of construction is the radio cabinet illustrated, which is put together entirely with common nailed butt joints. The style follows that of the now popular Spanish Vargueno desks. The box part is 18 by 18 by 28 in. Similar cabinets, although somewhat larger and more ornate, have sold in exclusive New York furniture shops for \$125 each.



Simplified radio cabinet, Blueprint No. 35

### Complete List of Blueprints

ANY one of the blueprints listed below can be obtained from POPULAR SCIENCE MONTHLY for 25 cents. The Editor will be glad to answer any specific questions relative to tools, material, or equipment. Blueprint Service Dept.

Popular Science Monthly

250 Fourth Avenue, New York

GENTLEMEN:

Send me the blueprint, or blueprints, I have underlined below, for which I inclose.....cents:

No.	Title	Published	Price
1.	Sewing Table	Feb., '22	25c
2.	Smoking Cabinet	Mar., '22	25c
3.	End Table	Apr., '22	25c
5.	Kitchen Cabinet	May, '22	25c
8.	Shaving Cabinet	June, '22	25c
9.	Arbor, Gate, and Seats	July, '22	25c
10.	Porch Swing	Aug., '22	25c
11.	Bench and Tilt Table	Sept., '22	25c
12.	Electric Washer	Oct., '22	25c
13.	Tea Wagon	Nov., '22	25c
14.	Christmas Toys	Dec., '22	25c
15.	Workshop Bench	Jan., '23	25c
16.	Inlaid Radio Cabinet	Feb., '23	25c
17.	Cedar Chest	Mar., '23	25c
18.	Phone Table and Stool	Mar., '23	25c
19.	Grandfather's Clock	Apr., '23	25c
20.	Flat-Top Desk	Apr., '23	25c
21.	Colonial Desk	Apr., '23	25c
22.	Cabinet and Desk	Apr., '23	25c
23.	Pergola Garage	May, '23	25c
24.	Gateleg Table	June, '23	25c
25.	Canoe Sailing Outfit	July, '23	25c
26.	Baby's Crib and Pen	Sept., '23	25c
27.	Kitchen-Cabinet Table	Oct., '23	25c
28.	Pullman Play Table	Nov., '23	25c
29.	Toy Tea Cart, etc.	Dec., '23	25c
30.	Tool Cabinet, etc.	Jan., '24	25c
31.	Sewing Cabinets	Feb., '24	25c
32.	Chinese Game Table	Mar., '24	25c
33.	Dining Alcove	Apr., '24	25c
34.	Garden Trellises	May, '24	25c
35.	Simple Radio Cabinet	Oct., '24	25c
36.	Rush-Bottom Chair	Nov., '24	25c
37.	Simplified Bookcase	Dec., '24	25c
38.	Sheraton Table	Jan., '25	25c
39.	Salem Chest	Feb., '25	25c
40.	Desk in Sheraton Style	Mar., '25	25c
41.	One-Tube Radio Set	May, '25	25c
42.	Three-Stage Amplifier	June, '25	25c
43.	Four-Tube Receiver	July, '25	25c

Name.....  
(Please print)

Street.....

City and State.....



## Like a slap in the face

**H**E had failed to land the job. He had wanted it as he had never wanted anything before—and the President had seemed to like him at first, too. Then—what was it he had said?—"Young man, personal appearance is of primary importance in a successful business career." What had he meant?

\* \* \*

A great many young men are inclined to have a grimy-looking skin, spotted with blackheads and dull in appearance. Few realize that this hinders their success in life. Pompeian Massage Cream helps you overcome this handicap by giving you a clear, ruddy complexion.

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**Clears the Skin:** Pompeian Massage Cream thoroughly cleanses the

pores. It helps clear up blackheads and pimples by stimulating healthy circulation, and by keeping the skin clean and the pores open.

**Easy to Use:** After shaving or washing, rub it in gently. Continue rubbing and it rolls out, bringing with it all the dirt and skin impurities. Result—a clean, healthy skin with clear, glowing color.

### Special Introductory Offer

1/3 of 60c jar for 10c.

For 10c we send a special Trial Jar containing one-third of regular 60c contents. Contains sufficient Pompeian Massage Cream to test thoroughly its wonderful benefits. Positively only one jar to a family on this exceptional offer.

### YOUR DRUGGIST HAS IT

There's nothing quite so effective as doing the job yourself. Use Pompeian Massage Cream regularly at home—then you'll get the full benefit.



The Pompeian Co., Cleveland, O., Dept. 41

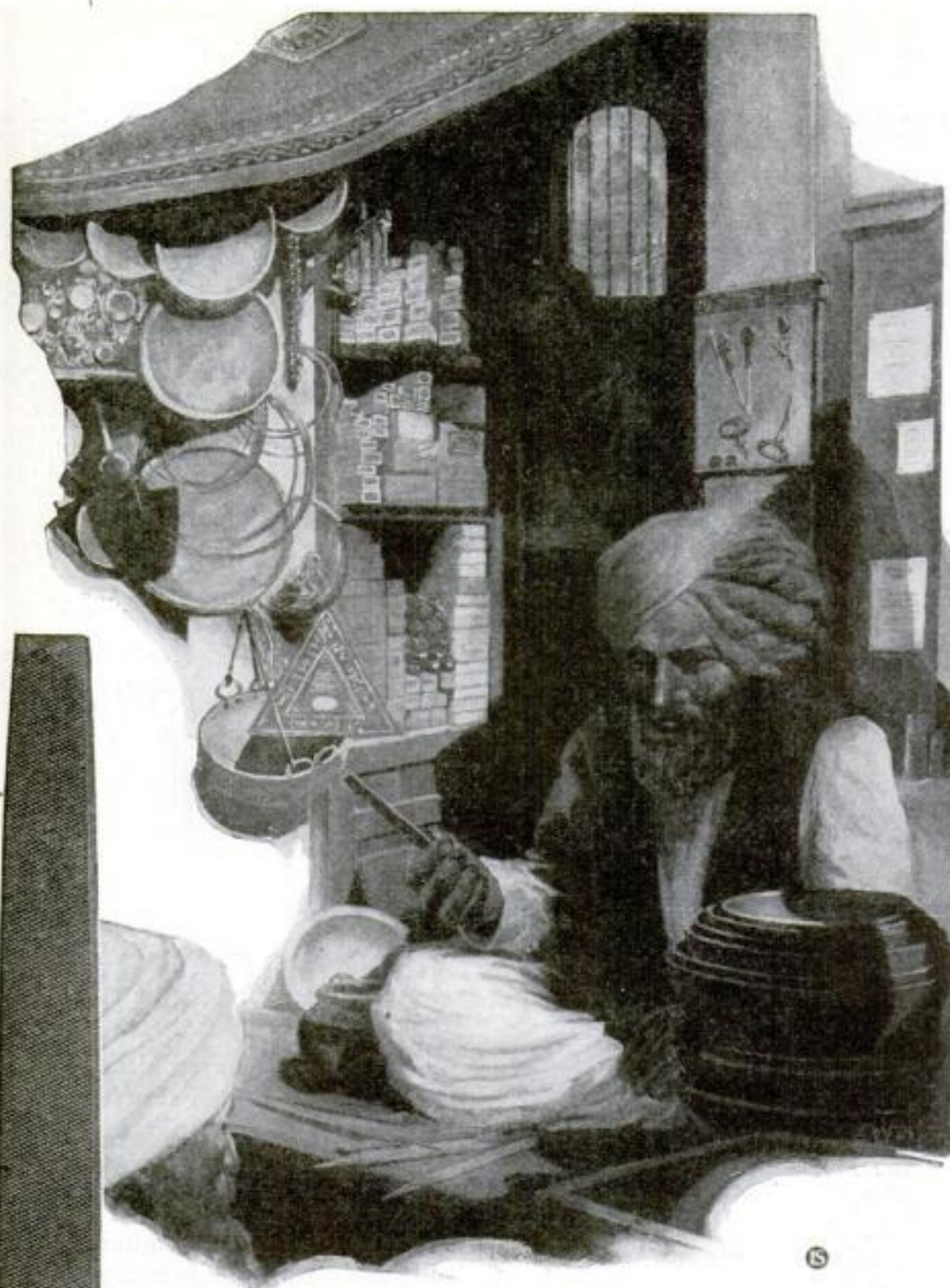
Gentlemen: I enclose a dime (10c) for 1/3 of a 60c jar of Pompeian Massage Cream.

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## India, like the rest of the world, sends to this country for NICHOLSON Files

Tradition and iron-clad custom permeate the commercial as well as private life of the people of far away India.

NICHOLSON Files, because of their outstanding superiority, years ago broke through tradition. The turbaned merchants sell them in the bazaars from Baluchistan to Burma, and the people demand them for everyday and industrial use.

And a rule as rigid as India's caste system is that the NICHOLSON trade mark shall always be stamped on the tang.



**NICHOLSON FILE CO.**

PROVIDENCE, R. I., U.S.A.

# NICHOLSON FILES

~ a File for Every Purpose

## The Home Workshop

### Unique Yule-Time Decorations

(Continued from page 76)

row about 12 in. high and the other row about 6 in. Tack these to strips of wood. Kalsomine the hills and sprinkle with snow.

Put a line of wet plaster on the mantel cloth about 3 in. from the canvas and set the larger row of hills in the plaster. Do this with the smaller row of hills, setting these 3 in. in front of the larger row.

Get some mailing tubes about 3 ft. long and 1 in. in diameter. Cut these any length you like, and stick each in a lump of wet plaster in front of the hills, the larger ones at either end of the mantel and the smaller ones on each side of the crib. Kalsomine these tubes and sprinkle with snow. On top of the tubes glue a chandelier cap or collar and place a colored candle in each tube. Dab a little kalsomine on the candles and sprinkle with snow or ground mica.

FOR the drapery frame, place two screweyes in the ceiling on an even line with the outer edges of the mantel and two screweyes at even distances apart on a line with the end ones. Tie strong cord through these. From the end screweyes bring other pieces of strong cord to the front edge of the mantel, fastening them to tacks in blocks of wood that have been stuck to the mantel with wet plaster.

For drapery use fine red crape paper, pinning it around the cord at the top and sides. Edge the paper with gold or silver bronze or gold or silver string tinsel. Pin a Christmas-tree ornament in the center at the top and two small Christmas wreaths with red crape paper bows in the middle of the drapery on either side.

It is well to hang two strips of snow-sprinkled muslin as wings on each side of the mantel from the cornice to the mantel and a fly piece at the top, inside the drapery, to hide the ends of the canvas at the sides and the cornice at the top. These side wings and top fly piece can be edged with gold or silver bronze or gold or silver tinsel pinned to the muslin.

Get some small tree or plant twigs, punch holes in the canvas with an ice-pick, and stick the twigs in the canvas. Dab a little kalsomine on the twigs, sprinkle with snow, and hang with tinsel in single strands.

Place some small cardboard houses, which can be bought for 25 cents a box, along the mantel. Snow their roofs and further decorate the top of the mantel with artificial poinsettias, pieces of holly, and bits of gold and silver tinsel. Illuminate the scene at night with electric lights, experimenting to get the best arrangement of the lamps.

Mantel decorations of this type are especially interesting when worked out by a group of young people, as for a Sunday-school or lodge entertainment.

A PLAIN wood scraper about 4 by 10 in., made from an old saw, is very handy in knocking off the hardened excess glue from joints preparatory to planing, scraping, and sandpapering large surfaces such as table and counter tops.



**EVEREADY HOUR**  
**EVERY TUESDAY AT 9 P. M.**  
*Eastern Standard Time*

For real radio enjoyment, tune in the "Eveready Group," broadcast through stations—

WEAF New York	WCAE Pittsburgh
WJAR Providence	WSAI Cincinnati
WEEI Boston	WWJ Detroit
WTAG Worcester	WCCO Minneapolis
WFI Philadelphia	St. Paul
WGR Buffalo	WOC Davenport



## For radio economy

EVEREADY Radio Batteries are noted for their long service and economical operation. They are made in different sizes and types so that every radio user can enjoy the economy and convenience to be had by fitting exactly the right Eveready to his receiver. The five dry cell types of Eveready Radio Batteries are here illustrated and described to make it easy for you to decide just which will give the longest and most economical service on your set. A dealer near you sells Evereadys.

### *Eveready Heavy-duty "B" Battery for four or more tubes*

No. 486. *Extra-large Layerbilt*. 45 volts. Vertical. Eveready's latest contribution to radio. The new Layerbilt construction which gives much greater service. Same size as No. 770. Price \$5.50.

### *Eveready "B" Battery for one to three tube sets*

No. 779. *Large*. 22½ volts. Vertical. Especially adapted for Radiola 25, DeForest D-17 and Operadio receivers. Same capacity as No. 766, and suitable wherever variable taps are not required. Price \$2.00.

### *Eveready "B" Battery for portable sets*

No. 764. *Portable*. 22½ volts. Vertical. For portable sets where medium weight and size are permissible. Price \$1.75.

### *Eveready "A" Battery*

Eveready Columbia Ignitor Dry Cell Radio "A" Battery for all dry-cell tubes. 1½ volts. The dry battery used by vacuum-tube engineers in developing the dry-cell tube.

### *Eveready "C" Battery*

No. 771. 4½ volts. Saves "B" Batteries, improves tone. Price 60 cents.

*Manufactured and guaranteed by*

**NATIONAL CARBON COMPANY, Inc.**  
 New York San Francisco

Canadian National Carbon Co., Limited, Toronto, Ontario

# EVEREADY

## Radio Batteries

—they last longer







**Good Tools**  
are a

**Mechanic's "Strength"**

To be an expert mechanic you need not have the muscular development of a great athlete. Your "strength" lies in your tools and in your skill to use them. If you own a kit of good tools, you are prepared to try your skill with the best of mechanics. With poor tools, your skill is hindered, and you cannot do your best.

When your kit is Brown & Sharpe equipped, you can do better and quicker work.

Write for Small Tool Catalog No. 29. It lists over 2000 Brown & Sharpe Tools in which you will be interested.



**Brown & Sharpe Mfg. Co.**  
Providence, R. I., U.S.A.

**BROWN & SHARPE**

*"Standard of the Mechanical World"*

## The Home Workshop

### Electric-Lighted Doll's House Costs Little to Build

By Harold E. Dean



The assembled doll's house, 22 by 40 in. in area and 22 in. high, is entirely weatherproof

ONLY a pocket-knife, a small block plane, odd scraps of material, miniature electric lights, and a supply of glue and patience were required for the building of the doll's house illustrated.

It is a model of a seven-roomed house I once owned and is 22 by 40 in. in area and 22 in. high. With cigar boxes as lumber and old linoleum for the shingled roof, the building cost very little.

The shingles are put on with the canvas side up. The windows are of glass, with narrow strips of wood glued on to give the appearance of small panes. The Dutch-style front door is in two sections. The floors are laid with linoleum parquet.

Beside having a beamed ceiling, the living-room contains a fireplace made of coarse sandpaper, the joints between the stones being marked with pencil lines.

As the roof, second story and upper porch are built separately, the house can be taken apart. The sides also are hinged so that they can be opened out. This makes the house a true doll's home, because every part is accessible.

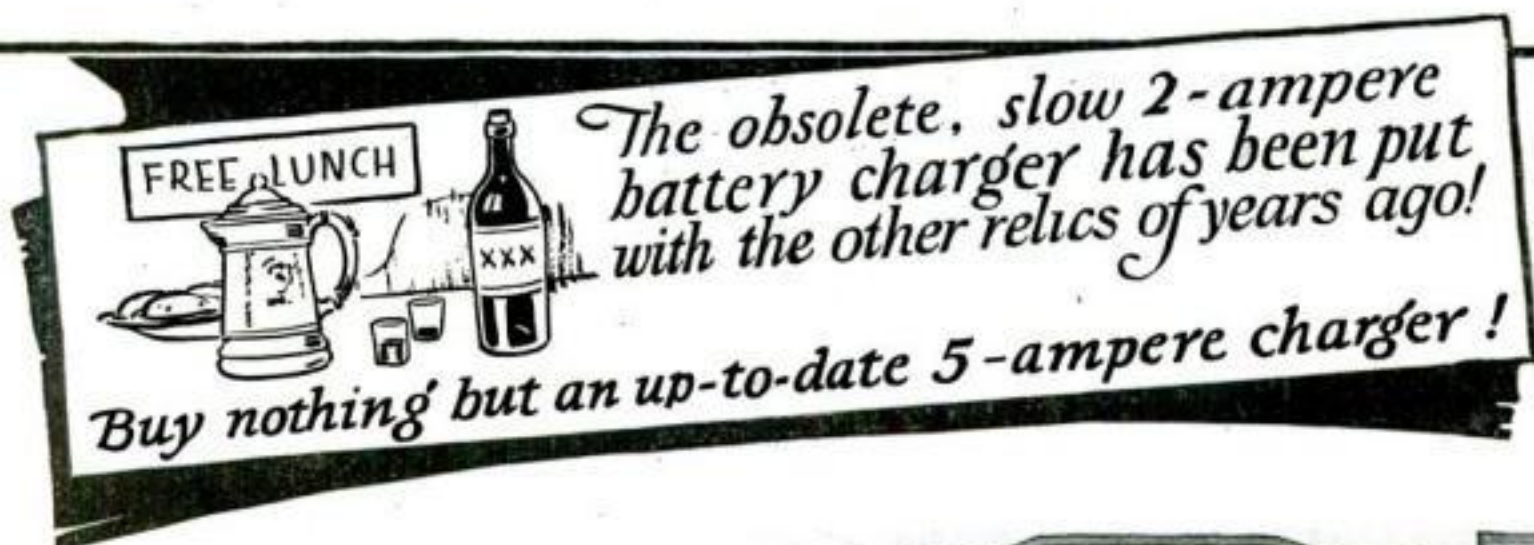


All the rooms are accessible and there are lights, parquet floors, and a fireplace

### Articles to Appear Soon

*How to Replace a Broken Window Light, Sharpening Your Saw, Thrilling Rides on a Toboggoplane, How to Construct a Portable Kitchen Cabinet, Overhauling a Ford Rear Axle, Easily Built Sand Table for the Nursery, and How to Make an Ornamental Magazine Holder.*





*The New Improved*  
**5 AMP. A & B**  
**GOLD SEAL**  
**HOMCHARGER**  
**\$19<sup>50</sup>**



Over 500,000 already in use

# *Charges in One-Third the Time!*

## **Better Because:—**

New micrometer adjustment, hinged lid, and carrying handle.

No bulbs to buy or break.

Can be used anywhere—contains no acids or other harmful liquids to spill.

Approved by underwriters—trouble-proof, shock-proof and fireproof.

Beautiful cabinet in maroon and gold.

**Free** Write for new edition of our instructive booklet on radio operation "The Secret of Distance and Volume in Radio."

It takes only one-third as long to fully charge your battery with the New Improved 5-ampere GOLD SEAL HOMCHARGER.

No more of the long, bothersome waits that were necessary when the slow inefficient 2-ampere charger was the best that radio offered. The New Improved GOLD SEAL HOMCHARGER charges 150% faster—fully charges the average battery overnight—and it charges both A and B batteries without additional equipment.

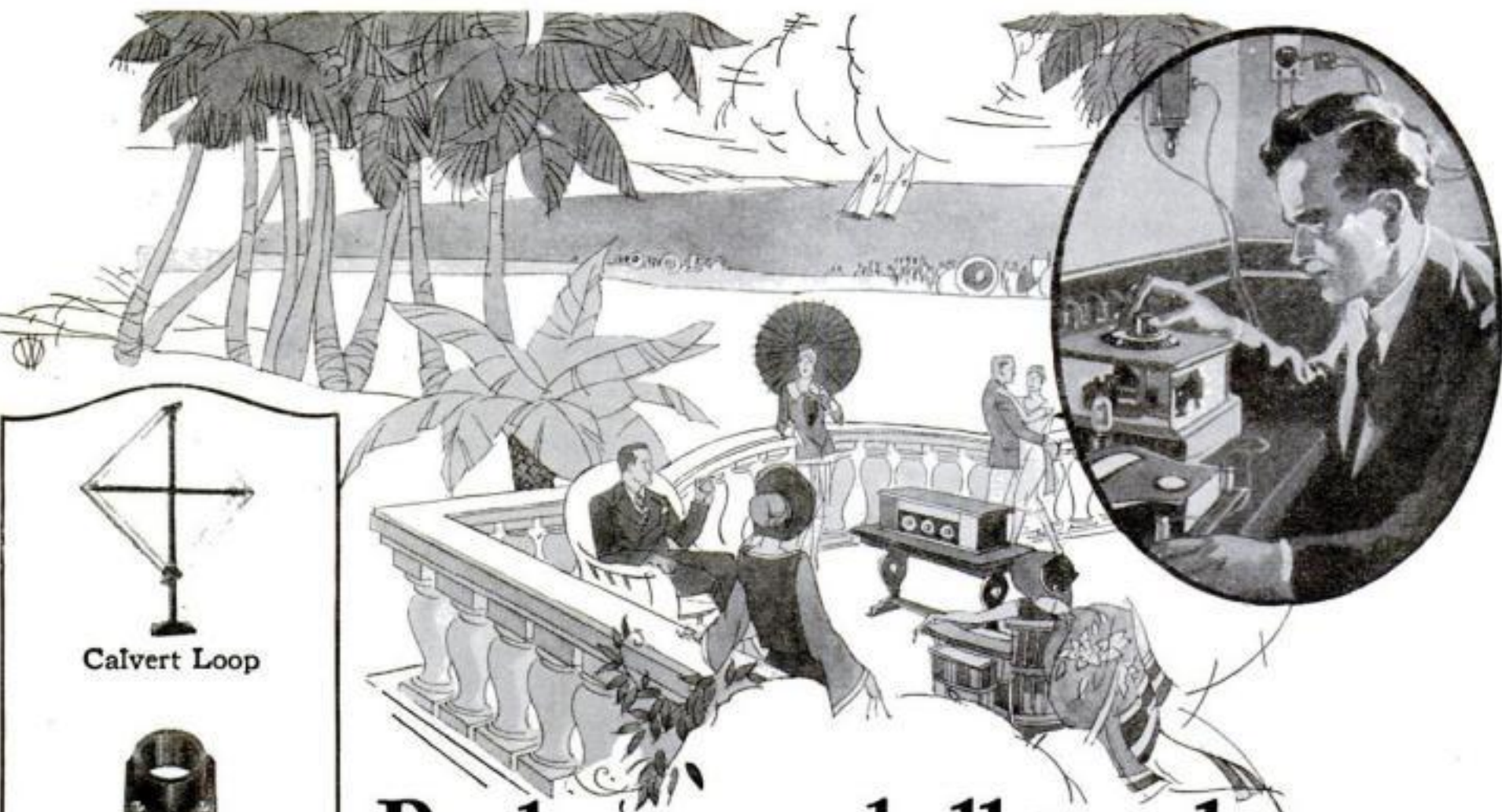
Before you buy any charger be sure it charges at 5-amperes. To be absolutely sure insist on the GOLD SEAL HOMCHARGER.

®

**The Kodel Radio Corporation**  
 500 East Pearl Street Cincinnati, Ohio







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Tube Socket



Mason Z & T Jr.  
Detector



Saal  
Soft Speaker



Pacent Knob



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## Radio tested all insulations- *and adopted Bakelite*

In the laboratories of radio manufacturers, in actual use in all climates and under adverse conditions, Bakelite has proven its superiority for radio insulation.

The reason for this dominance of Bakelite in radio is easily understood. Its high insulation value, so essential to tonal quality, is unimpaired by time, temperature variations or by service.

Bakelite is generally used for exposed radio parts, dials, knobs, panels and accessories, because its color and high finish are permanent, undimmed by exposure or handling.

The use of Bakelite in the set you buy or build, will insure you against inferior reception through defective insulation. It will pay you to make sure that Bakelite is used in the radio set or parts that you buy.

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## THE MATERIAL OF A THOUSAND USES



## The Home Workshop

### Your Christmas Tree

(Continued from page 69)

more long (A), fitted together as shown in the plan, so each in turn is butted against one board and nailed to the end of another. The four partition off a central space determined by the diameter of the tree. This is all that the base requires. The ends of the boards may be slanted or otherwise trimmed down, but for the purpose of utility you can fit boards to their upper edges (B), forming shelves on which the Christmas gifts may be arranged.

When the holiday festivities are over and the time has arrived to remove the tree and return things to normality, a trail of needles generally marks the path of the tree to the door or window from which it is thrown. This muss is unnecessary. When the tree has been dismantled, lop off its branches one by one with a small saw until nothing remains but the trunk. The cut boughs then may be packed in a bushel basket or coal hod and carried out, or, if there

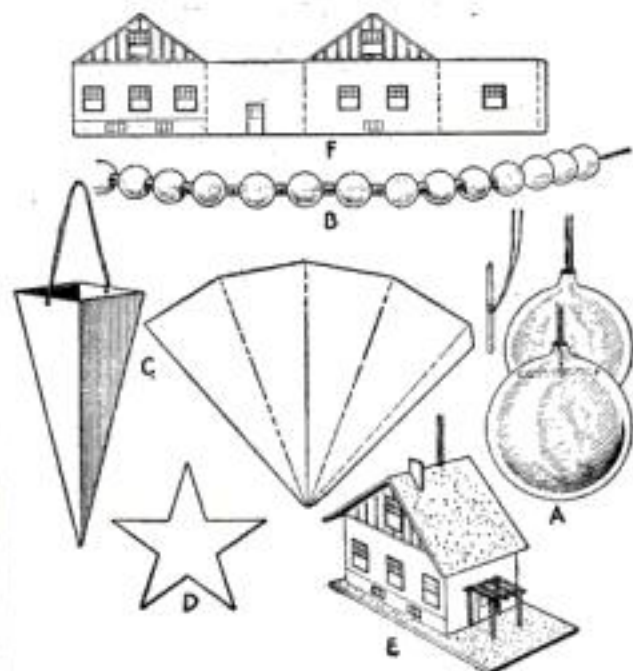


Fig. 2. How to replace Christmas-tree ornament hangers, and homemade decorations

is a fireplace, made into a glorious fire. At our home, this means of disposing of the tree is an event long anticipated.

In purchasing tree ornaments, you can expend considerable money, but with careful handling and proper packing for storage between seasons, the amount of breakage will be small, and the bulk of the trimmings should last indefinitely.

Broken glass ornaments are usually beyond hope of repair, but lost hangers, not infrequently the cause for putting aside ornaments otherwise in good condition, are replaced easily. Taking, for example, the glass ball ornament shown at A, Fig. 2, it is necessary only to tie a piece of thread to the center of a burnt match or toothpick and slip the match into the opening in the ball, allowing it to drop below the opening so it will turn to a horizontal position, as indicated by dotted lines.

Homemade ornaments are coming into their own again, as in the days before commercial decorations were plentiful. Making them is a favorite occupation of children at school and at home. It gives

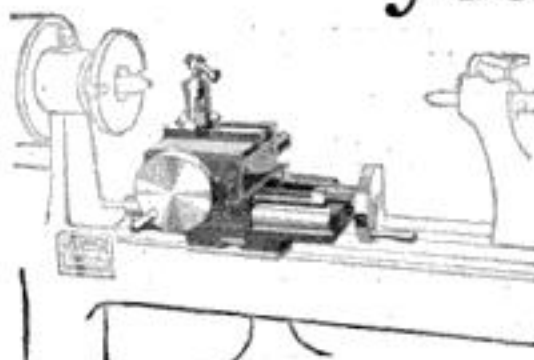
(Continued on page 92)

No. **125**

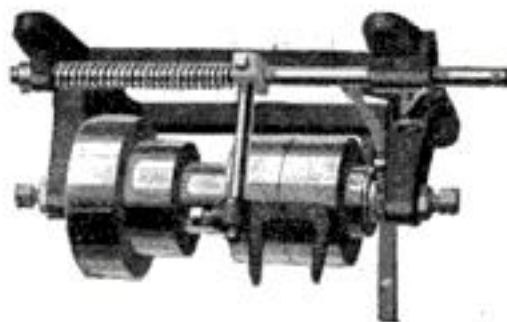
Bench Lathe  
Complete as  
Illustrated  
Price \$36



## Turning and Boring in your home shop



No. **132** Slide Rest  
Price \$16



No. **130** Counter Shaft  
Price \$11

AS soon as you set up this lathe on your work-bench, you are ready for all sorts of boring and turning jobs.

Just the right size for a small workshop. Length over all, 25 inches; height, 11½ inches; swing, 7 inches; extreme distance between centers, 12 inches. Weighs only 30 pounds.

Well-made and finished with black and red enamel. The bed is milled. All working parts handsomely polished. Live spindle has a cone bearing to take up wear. Tail stock has screw and lever feed. Cone pulley has three steps—1½, 2½ and 3½ inches in diameter.

A complete line of attachments is available to fit this lathe, such as slide rest, lathe tools, compression check and collets, milling attachments, turret attachments, etc.

### Bench Lathe No. 494

Same construction as No. 125 above, but slightly larger. Length over all, 31 in. Height 11½ inches. Swing, 7 inches. Extreme distance between centers, 18 inches. Weight, 36 pounds. Price, \$40.

### Interesting Bench Lathe Booklet Free

Shows all the Goodell-Pratt Bench Lathes, also various attachments that enable you to do all sorts of turning, boring, milling, sawing jobs, etc. Gives the amateur mechanic many new and valuable hints for working out his ideas. A post card will bring you a copy of the booklet free. Just ask for the Goodell-Pratt Bench Lathe Booklet.



GOODELL-PRATT COMPANY  
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*Toolsmiths*

Makers of Mr. Punch

**GOODELL-PRATT**  
1500 GOOD TOOLS





## Hogs for Work

**J**OBs that take an hour with open-end or "monkey" wrenches, are half-hour snaps with a set of Blackhawk "Q. D's". Click a snug-fitting socket onto one of the handy handles, and you have a socket wrench that saves time and temper. Why toil with old-style tools?

Nothing delicate about Blackhawk "Q. D's". The heat-treated special steel sockets are far too tough to break or wear "sloppy". The balanced handles with comfortable hand-fitting grips are extra thick. If your dealer has not yet been supplied, write direct for details and prices.

### BLACKHAWK MFG. COMPANY

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Dept. L

Milwaukee, Wisconsin

Also manufacturers of  
Blackhawk Water Pumps  
for Fords.

# BLACKHAWK

Welded Wrenches

## The Home Workshop

### Your Christmas Tree

(Continued from page 91)



Fig. 3. A unique window wreath illuminated at night by a flashing electric light

them the pleasure of feeling that they have a part in the holiday preparations and also shortens the interminable wait for Christmas to arrive.

A few suggestions for homemade ornaments are shown in Fig. 2. Strings of beads can be made of cranberries and glass beads strung upon linen thread, then gilded as at B. Square-shaped cornucopias for small Christmas candies can be prepared as shown at C. Each is made of a piece of colored paper laid out and cut as indicated, then folded along the dotted lines, and the side edges lapped and pasted. A piece of tinsel cord forms the hanger.

**S**TARS of different sizes, cut out of tinfoil, make pretty ornaments. At D is shown a five-pointed star that may be laid out easily. Divide the circumference of a circle of the desired diameter into five equal parts, connect each point of division and two opposite points with straight lines, and the star is formed.

While on the subject of tinfoil, do not forget that you can slash pieces of it into narrow strips to hang over the tree branches as shown in the photograph on page 69, in imitation of icicles, though bunches of these strips can be purchased so inexpensively that it hardly pays to bother with cutting them.

Cardboard cottages sprinkled with "diamond dust" are attractive ornaments. A suggestion for one is given at E, and at F is shown how to lay out the walls in one piece. Draw the walls, with door and window openings and trimmings marked off with crayons, as indicated; cut out the piece, fold on the dotted lines, and paste the ends together. Then cut a piece to form the roof and a piece for the base, and glue them to the wall edges. Build the entrance pergola of match-sticks. When the cottage has been assembled, coat its surface with paste, then sprinkle with "diamond dust" which is powdered mica sold for imitation snow.

A Christmas greeting added to the

(Continued on page 95)



# The Camera for Christmas



## The Lens:

Kodak Anastigmat *f.7.7* lens is a sharp-shooter—it puts keen definition in the negative. Result, snappy prints—and enlargements when you want them.

## The Shutter:

The Eastman-made Diomatic shutter has four snap-shot speeds up to 1/100 second as well as time and bulb actions, and these speeds are accurate. This precision, plus the presence of the automatic exposure dial which gives the proper timing at a glance, means correctly exposed negatives.



*Enlarged from a negative made with 1A Pocket Kodak, Series II. This camera makes such sharp pictures that when you want enlargements you can have them.*



## No. 1A Pocket Kodak, Series II

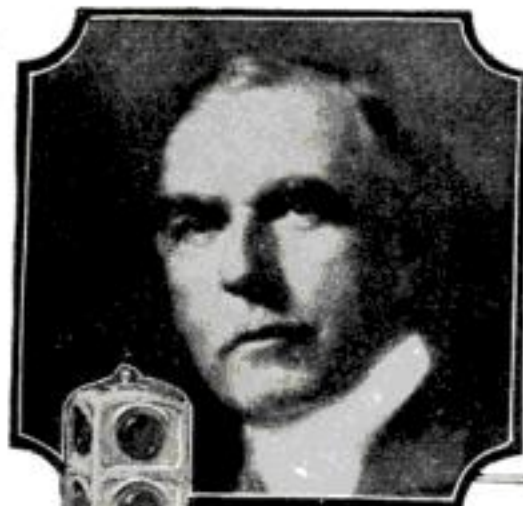
With the equipment as described above, you can count on sharp, properly timed pictures that would satisfy an expert. And to work the camera is simplicity itself. For example, as you open it up the lens springs into picture-making position.

The 1A, Series II, is the kind of a camera you would be happy to have or glad to give.

*Pictures 2½ x 4¼. Price \$26.*

**Eastman Kodak Company, Rochester, N.Y.,** *The Kodak City*





**The Late A. H. Smith**  
Famous President of the New York Central Lines, under whose direction the gigantic task of electrifying the road from New York City to Harmon, N. Y., was accomplished.

The boys who today are learning railroad principles by running their Lionel Model Railroads are fitting themselves to be America's transportation leaders of the future.



**Lionel Automatic Train Control.** The greatest achievement in model railroad engineering. Starts and stops trains automatically. Just one of the many wonderful realistic railroad devices in the Lionel line of Accessories.

## Lionel Trains and Real Trains Differ Only in Size!

**W**HEN you wake up on Christmas morning and see your own Lionel Model Railroad—

You'll be the happiest boy in town.

Lionel engineers are skilled in the art of developing electrically and mechanically perfect Model Trains and Railroad Accessories in exact reproduction of the latest big electric railroad devices.

For twenty-five years they have built Lionel Model Railroads, Multivolt Transformers and Model Railroad Accessories that *look like* real trains and *work like* real trains.

Lionel Standard Locomotives for 1925 are more powerful than ever. They are equipped with the wonderful "Three-point armature shaft bearing Super-Motor" and new reduction gearing that greatly increase hauling power and reduce current consumption.

Be sure to examine the great detail of Lionel Locomotives, Coaches and Accessories—the powerful 8-wheel, twin-motor locomotives for both Standard and "O" Gauge Track—real electric headlights—Lionel automatic couplers—the latest 6-wheel trucks on

the largest Pullman and observation cars—interior car lighting—everything that represents a real railroad.

Take father and mother to your store to see these amazing Lionel Model Railroads. Then you'll know and they'll know why more Lionel Railroads were sold last year than any other make. And remember: Lionel trains are lowest in price consistent with high quality—complete outfits from \$5.75 up. (Slightly higher in the far West.)

*For sale at all good toy, hardware, sporting-goods, electrical and department stores.*

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PATENTED  
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FEATURES



**The Lionel Bell Warning Signal.** As the train approaches the grade crossing, bell automatically rings—stops ringing as soon as train has passed. Steel construction throughout.



No miniature railroad is complete without the new Lionel Automatic Crossing Gates. Down goes the gate as the train approaches—up again when the train has passed. It works by itself—just like the real ones.



**Lionel "Multivolt" Transformers.** Ever-reliable power plants. Run all trains best. A type for every size train.

"STANDARD OF THE WORLD SINCE 1900"

# LIONEL ELECTRIC TRAINS

MODEL RAILROAD ACCESSORIES

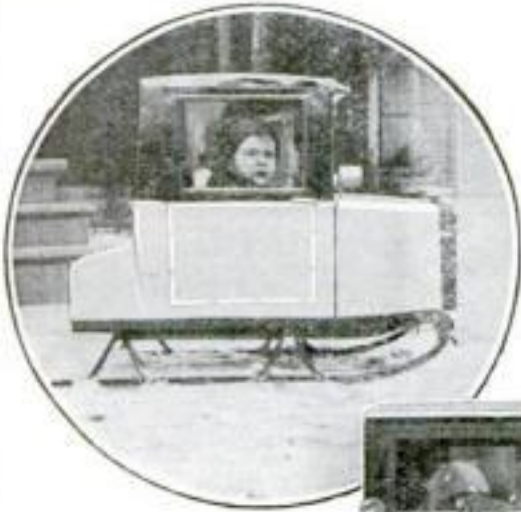
## "MULTIVOLT" TRANSFORMERS



## The Home Workshop

### Tiny Auto Sled Replaces Baby-Carriage in Snowtime

ANY one who has had to push a baby-carriage through the snow will appreciate the advantages of the snugly inclosed child's sled illustrated. It is



In this trim-looking auto sled a small child is sheltered perfectly from wind and snow. The radiator and windshield are lifted bodily to allow access to the upholstered interior



built like a miniature auto and is large enough for a child up to three years of age.

The wooden framework is 15 in. wide, 22 in. high, and 3 ft. long, and is covered with tin. The radiator is made of 1/4-in. mesh wire painted black.

The inside is upholstered in black imitation leather. The outside is enameled black in the upper part and light blue in the lower.—OSCAR SITTIG.

### Your Christmas Tree

(Continued from page 92)

window wreath gives it a personal touch. Illuminate it and it will be visible by night as well as by day. Put the light on a flasher and the greeting will be almost as emphatic as spoken words.

In Fig. 3, which illustrates the electric-lighted wreath, A shows the back of the wreath. The diameter should be 16 in. or more, that the lettering may be made large. B is a back view of the wreath with the greeting card and light; C is a detail of the card and light, and D shows the automatic flashing device, which can be purchased at most electrical supply houses. The completed wreath is pictured at E.

Rule lines across the card between which to letter the greeting. Cut them out and back up the openings with transparent red paper.

Make the block base for the lamp receptacle about 3 in. square. Bore a hole through it for a lamp cord, screw a porcelain receptacle to the block, and connect the wire with the receptacle and an attachment plug.

That the lighted wreath may express "Happy New Year" as well as "Merry Christmas," make a second card to insert behind the wreath for the week following Christmas.

## A Gift that Inspires Gratitude

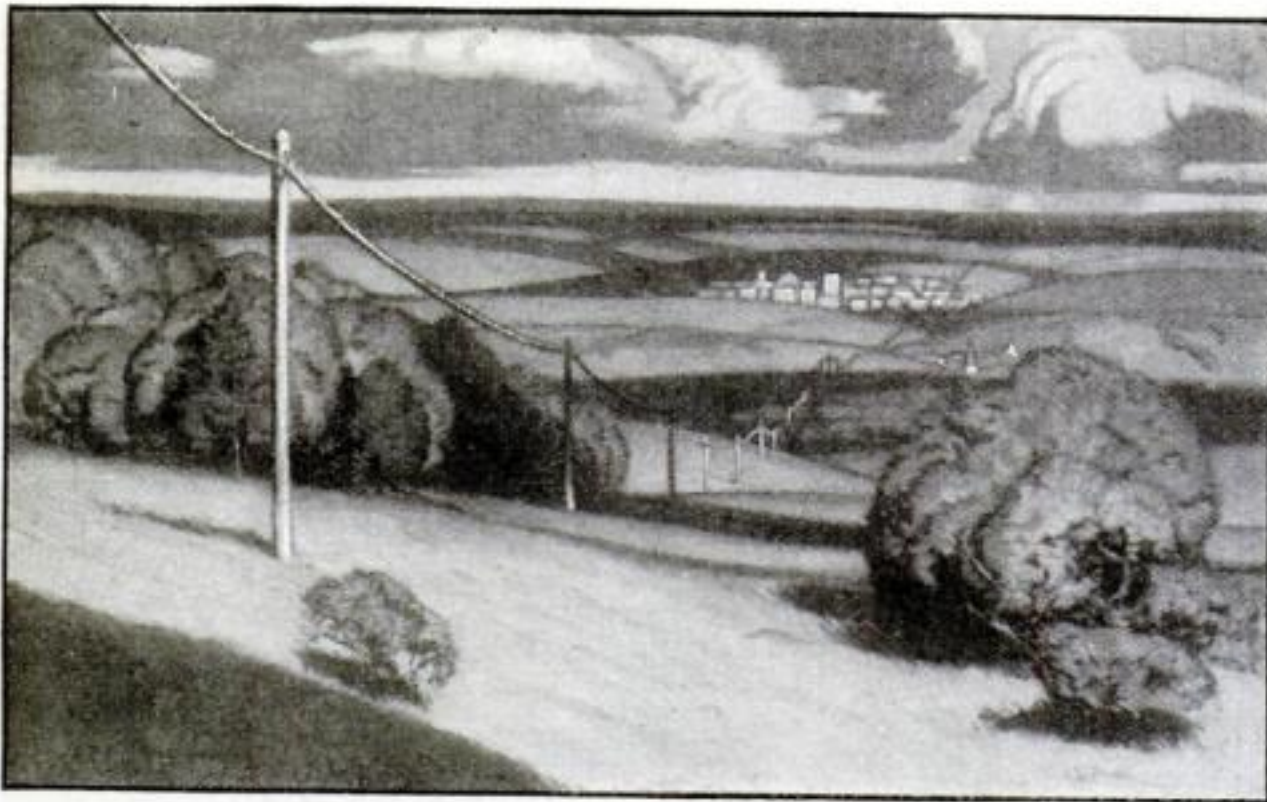
for Father or Mother  
for Son or Daughter  
for Teacher or Pastor  
for Dearest Friend

THIS Christmas Portable may be had in our handsome Christmas package without extra charge. For sale by over 5,000 dealers and Remington branches everywhere. Easy payment terms, if desired. Write for illustrated booklet, "For You—For Everybody". Address Department 67.

REMINGTON  
TYPEWRITER COMPANY  
374 Broadway, New York  
Branches Everywhere

# Remington Portable





## Safeguarding the lanes of speech

The New York-Chicago telephone cable has been completed and is now in service. A triumph of American telephone engineering, the new cable is the result of years of research and cost \$25,000,000 to construct. Its first reach extended along the Atlantic seaboard, then steadily westward until this last long section to Chicago was put into service.

To the public, this cable means dependable service irrespective of weather conditions. It is now not likely that sleet storms, which at times interfere with the open wire type of construction with 40 to 50 wires on a pole, will again cut off the rest of the nation from New York or from the nation's capital as did the heavy sleet storm on the day of President Taft's inauguration.

The new cable means speedier service, as it provides numerous additional telephone circuits and will carry a multitude of telephone and telegraph messages. It would take ten lines of poles, each heavily loaded with wires, to carry the circuits contained in this most modern artery of speech.

This cable, important as it is, is only one of the Bell System projects that make up its national program for better telephone service to the subscriber. It is another illustration of the System's intention to provide the public with speedier and even more dependable service.



AMERICAN TELEPHONE AND TELEGRAPH COMPANY  
AND ASSOCIATED COMPANIES  
**BELL SYSTEM**

One Policy, One System, Universal Service

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\$1  
A MONTH

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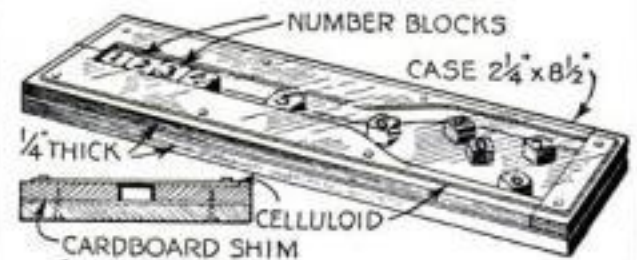
Name.....  
Address.....  
Occupation.....  
Employed by.....12T34

## The Home Workshop

### Novel Puzzle Familiarizes Children with Figures

QUICKLY and easily as this novel puzzle can be made, it is certain to give the children many hours of amusement.

The base is a piece of wood  $\frac{1}{4}$  by  $2\frac{1}{4}$  by  $8\frac{1}{2}$  in. The parts for the top are cut from wood of the same thickness, as are the number blocks. A cardboard shim is placed between the bottom and the top parts so that the blocks will have a small



The blocks are juggled around until the numbers are arranged correctly in the trough

amount of clearance when the celluloid cover is tacked in place.

The recesses and the blocks must be sandpapered so smoothly that the blocks can slide about freely. It is well to round a trifle the left-hand edges of each block to facilitate its entrance into the trough.

The object of the puzzle is to get the numbered blocks into the trough at the left in their proper order. This is accomplished by shaking the puzzle. As each block slides into place it is held from sliding back again by pressing down the celluloid top immediately above it.—DONALD W. CLARK.

### Small Fan Motor Adapted for Whipping Cream

ONLY a length of copper tubing and a rubber tube are needed to adapt a small electric motor for whipping cream. A small hole is drilled near the upper end of the copper tubing and one inch at the other end is bent at a right angle, the point being compressed to form a flat nozzle. This is attached to the motor, after the fan has been removed, by means of a tight-fitting rubber tube 3 in. long.

As the motor rotates the copper tube, a spray of air is drawn down through the upper hole and shot through the liquid. If the tube tends to vibrate excessively, it may be kept steady by placing the fingers lightly around it.

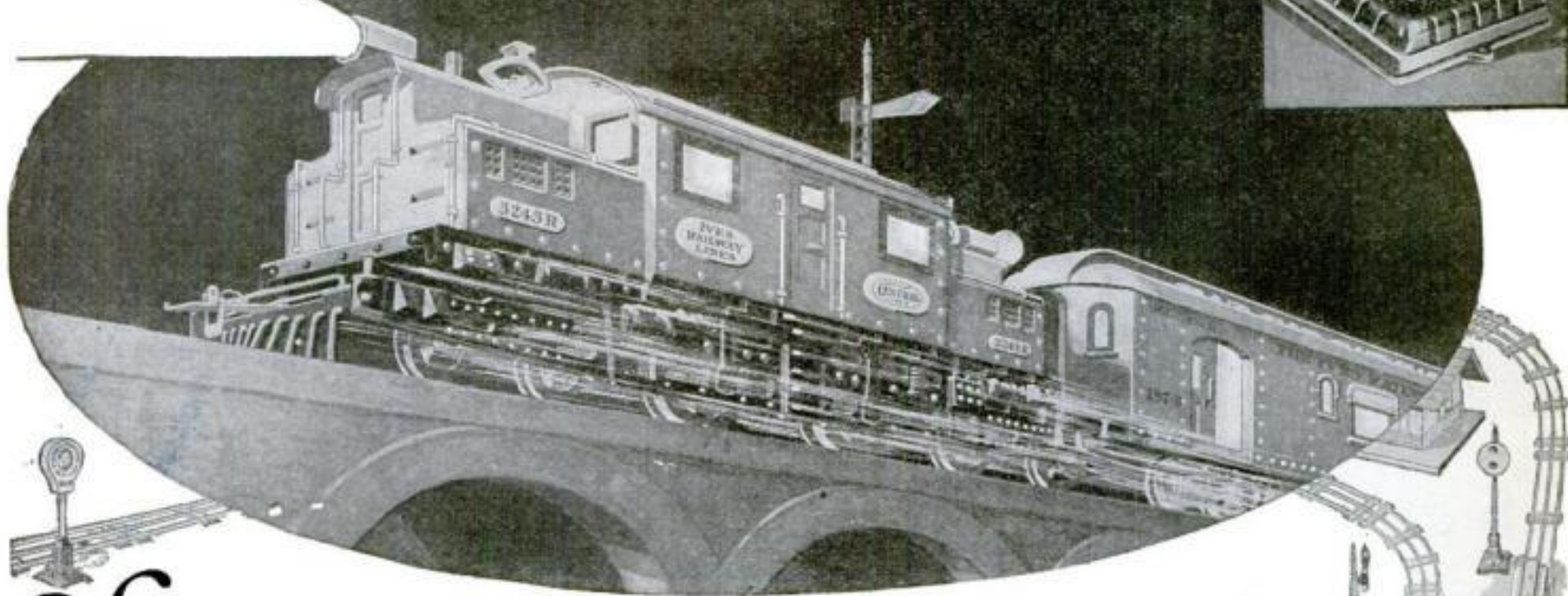
This device whips malted-milk drinks to foam in short order, thoroughly creams oil dressing, does not splash the liquid, and always works quietly, in short, is a constant delight to any housewife.—OWEN LOVEJOY.



A machine to replace the hand egg-beater



**IVES Push Button Control—stops and reverses the engine by a touch of the finger**



**Of course you want an electric train for Christmas!**

**But be sure you get a real one with all the 1925 improvements**

**T**HERE are many new, exclusive features in the 1925 Ives Electric Trains that will bring you hours and days and weeks of wonderful fun. Probably the biggest one of all is the electric reversing locomotive that made such a big hit last year.

This year the noted Westinghouse engineers and skilled Ives workmen have so perfected the control switch that now you need not even move the lever. You set this control switch for the speed you want. Then just a pressure of your finger on the button—the engine stops! Another touch—it backs!

*Exactly like the modern equipment of famous railroads*

It's a great sensation to see your locomotive reverse itself electrically at any position on the track without touching it by hand. Remember, boys, no other trains but Ives have electric reversing locomotives with the automatic push button control. It isn't a crude mechanical device on the locomotive or track, but a real electric automatic control oper-

ated from the switch. And this year you can have an Ives Electric Reversing Locomotive (Series R) on either O-gauge or 2 1/4-gauge track. Ives Trains are exactly like the modern equipment of famous railroads. Cars are electrically lighted and attractively finished in every detail. Every locomotive has worlds of power and a strong chassis so it can pull long trains at express speed. The small motors in the lower-priced locomotives are as carefully made as the big ones and are as powerful in proportion to their size.

There is an almost endless variety of passenger and freight cars, electric target signals and semaphore signals with electrically-operated arms, bridges, tunnels, stations, and the efficient Ives Transformers. Prices range from the \$1.50 mechanical train to the big complete \$50 electric outfit.

**32-page Book in colors tells all about the new features**

SEND for the 32-page book of Ives Trains and Accessories. It contains illustrations in colors of the full line and tells all about the new 1925 features exclusive with Ives. Mail the coupon today with 10 cents.

Toy, department, electrical, hardware and sporting goods stores sell Ives Trains.

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HOMES whose radio sets are battered with Eveready Columbia Ignitors have the pick of the programs of America. Eveready Columbias put you on top of the world by radio. They light the filaments of dry cell tubes day after day, night after night. Wise buyers always specify them, just as did the engineers who took this battery as the standard by which to design the dry cell tubes. That's why Eveready Columbias are as supreme for radio as they have been for years when used for ignition and hundreds of general uses. There is an Eveready Columbia dealer nearby.

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See Page 4 in front  
of book for details

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The logical place to get lowest prices with highest quality on small bench machines is from Boice, the World's largest makers. Whatever you build, there's a Boice machine to do your work; Circular Saws (6 sizes), Band Saws, Jointers (4 sizes), Lathes and Jig Saws. Write today for literature and prices on all Boice machines before you buy.

### 14" Band Saw

Table 12 in. x 14 in. tilts 45 degrees. Saws 7 in. stock. Uses blades 3-16 in. to 1-2 in. wide. Bronze bearings.

### Motors

$\frac{1}{4}$  H.P. Standard make, new, 110 V, 60 cycle single phase, A. C. 1750 R. P. M. With cord, plug and 11-2 in. flat or grooved pulley. Bronze bearings. Both motors guaranteed 100 per cent overload. These special offers not listed in regular price list. Made for immediate acceptance only. Prices F. O. B. Toledo. Cash with order only. Satisfaction guaranteed. Send today. All Boice machines sold with or without motor.

\$11.95

### Junior Saw

A speedy accurate machine. Table 10 in. x 13 in. elevates for grooving. 7 in. diameter saw cuts 2 1-8 in. stock. Does 5-8 in. x 5-8 in. Cuts mouldings. Driven by any 1-4 to 1-2 h. p. motor. Portable. Attaches to light socket. Attachments for grooving, sanding, grinding and drilling.

$\frac{1}{3}$  H.P.

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W. B. & J. E. BOICE

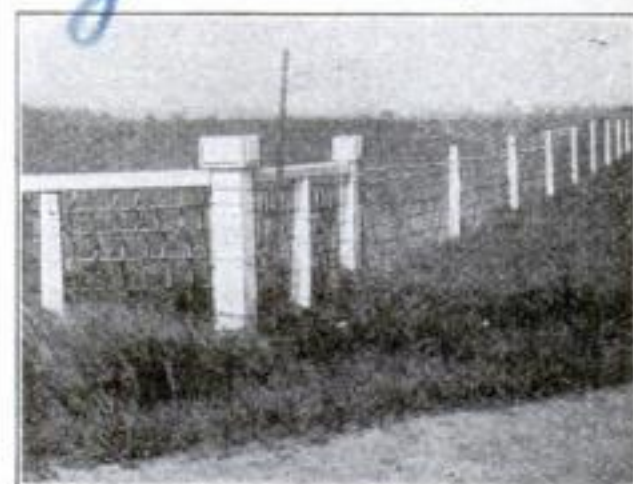
Dept. P. S. 12-A

Toledo, Ohio

## The Home Workshop

### Constructing Durable Corners with Concrete Fence Posts

HOW the corner-post problem may be solved when cement is used is shown in the illustration below. The corner post is made much larger than those along the line. The last post before the corner on either side of it also is somewhat larger than the other posts. These two posts and the corner are joined with slabs of cement at the top. The bracing slabs are supported in the middle by short cen-



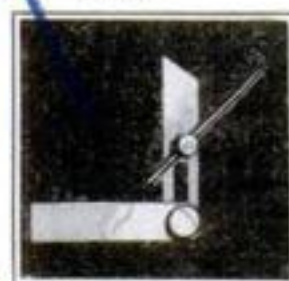
Three heavy posts connected with two concrete slabs share the strain at each corner

crete props. The resulting corner is of the greatest strength and durability.

On the Minnesota farm where this fence was built, caps were added to the three posts at each of the fence corners to make them more ornamental.—F. L. CLARK.

### Bevel Quickly Adapted to Serve as a Surface Gage

IF YOU require a surface gage in an emergency, you can improvise one with an ordinary bevel. An electrical binding post of the



DRILL-ROD SCRIBER  
BINDING-POST  
SLIDING BEVEL  
Improved gage

metal or telegraph type is attached to the slotted blade of the bevel, and a scribe made of drill rod is clamped in the binding post as illustrated.—W. J. E.

### One-Piece Metal Shelves

SMALL, light shelves can be made quickly from galvanized iron or any other sheet metal that happens to be available. Cut out a pattern as shown, fold on the dotted lines, and fasten to the wall with round-head screws. If ordinary sheet iron is used, it will pay to give the shelf a protective coating.



The pattern and a completed shelf



# Own a Typewriter

**A Bargain You Can't Ignore!  
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Will Use and Enjoy it! Try it  
Free, and See!**

**\$300 and it's!  
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**GET YOUR typewriter now.** A genuine Shipman-Ward rebuilt Underwood is the one you want—

"the machine you will eventually buy!" Everyone needs it; now anyone can afford it. Don't send a cent—but do get our big special offer—our valuable book on typewriters and typewriting—*free*.

You can learn to write on this standard-keyboard machine in one day. A week after the expressman has brought it, you'd feel *lost* without it. A trial will *prove* it—and doesn't cost you a penny!

Our rebuilt plan gives you the *best* machine, and saves you a *lot* of money.

Save on the price, and get a FIVE year guarantee.  
—  
All tools, cover, etc., included



This is a genuine No. 5 Underwood—the ace of standard writing machines.

**Act NOW If Ever !**

The Underwood is so famous a make, and No. 5 so popular a model, you'll have to speak up if you want one of the lot we are just completing now!

We rebuild from top to bottom; *replace every single worn part*; each machine is in *sparkling* condition. New typewriters are commonly guaranteed for a year; we guarantee these completely rebuilt Underwoods *five years*. That's our Better-Than-New Guarantee! And we guarantee a big saving in money!

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We don't ask for a cent now. Nor any money at all, unless you are completely won by the wonderful writing machine we ship you for an unrestricted 10-day free trial. When you do buy, take advantage of our very liberal scale of monthly payments. A host of our patrons have paid for their typewriters out of money made typing work for others. (One woman made a thousand dollars



at home last year with her Underwood.)

If you know typewriters, you know the perfect work and the ease and speed of an Underwood. If you have never owned a typewriter, start with the finest! One that will last you all your life! But, the time to act is NOW. Don't miss out on this present bargain offer. Don't do longer without the convenience of a typewriter. Our modern method of rebuilding, and our economical resale plan remove the last reason for not owning this time-saving, money-making, educational device.

## Free Trial Plan

Our plan gives you the opportunity of a *thorough* trial before you buy. You run no risk whatever. You start to pay for your typewriter *after* you have found it the one and only machine for you! But get the facts before this lot of machines is all in use. Clip the infor-

mation coupon before you turn the page. It will pay you! Note the very useful book you will receive free! Write for full particulars at once.

## Valuable Typist's Manual FREE!

Get our catalog that tells how we rebuild these wonderful Underwood typewriters in the largest factory of its kind in the world, and lowest prices and terms in existence. We will also include free, the new Type Writing Manual—it gives many examples and samples of uses for your typewriter: in business accounts, social correspondence, recipes, shopping lists, household accounts, etc.; school work; literary work, etc. This is a typewriting age; no home is complete without a typewriter. Clip coupon now!



**MAIL to**

SHIPMAN-WARD MFG. CO.  
2149 Shipman Bldg.  
Chicago

Please send full offer, with Type Writing Manual FREE, prices, terms, etc., and full information about your FREE course in Touch Typewriting. All without obligation; this is NOT an order!

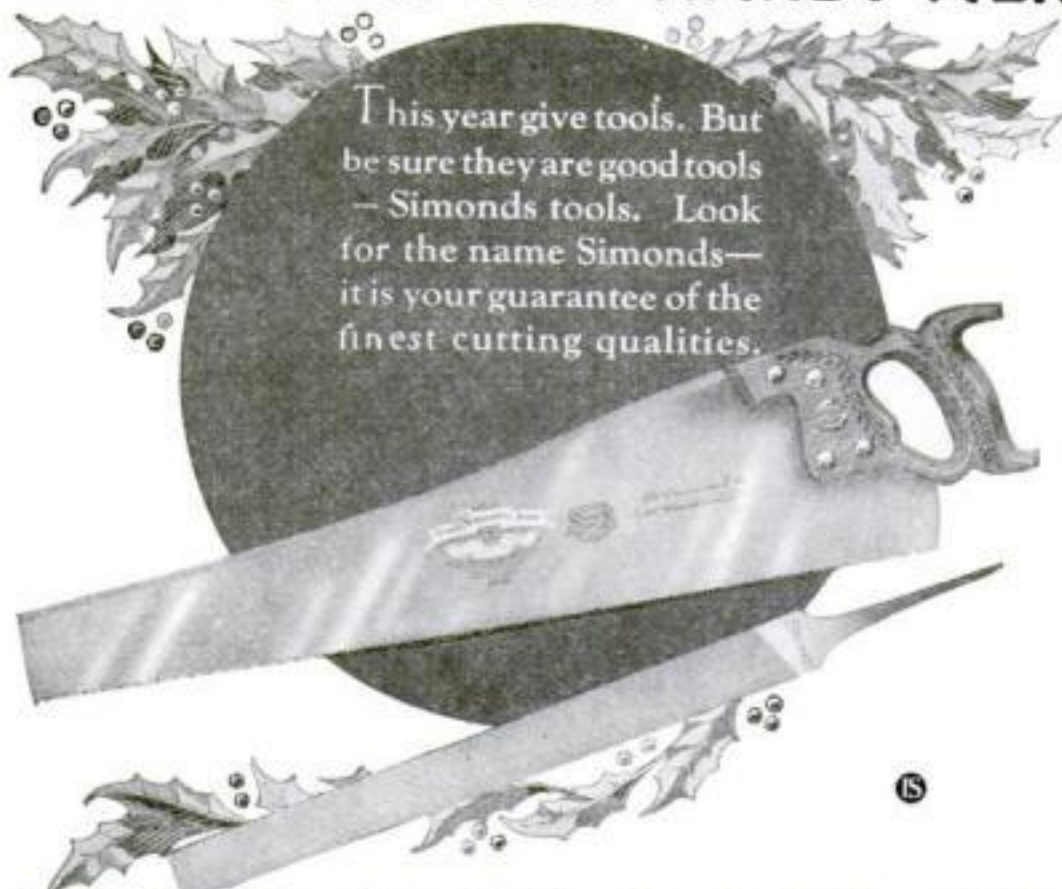
Name .....

St. or R. F. D. ....

P. O. .... State .....



## HANDY GIFTS FOR HANDY MEN



This year give tools. But be sure they are good tools—Simonds tools. Look for the name Simonds—it is your guarantee of the finest cutting qualities.

# SIMONDS

Pronounced SI-MONDS

## SAWS FILES KNIVES STEEL

SIMONDS SAW AND STEEL COMPANY, Fitchburg, Massachusetts  
"The Saw Makers" Branch Stores and Service Shops in Principal Cities Established 1832

### The Home Workshop

#### Folding Jewel-Box Opens Flat when It Is to Be Dusted

JEWELRY boxes of ordinary design get dusty in time, and pins and beads are apt to catch in the corners. This objection is overcome in the box illustrated, because it can be opened flat for cleaning.

The case is 10 in. long, 7 in. wide, and 5 in. deep and is made of Honduras

mahogany  $\frac{3}{8}$  in. thick. The front, back, and ends are hinged to the bottom with brass hinges that are

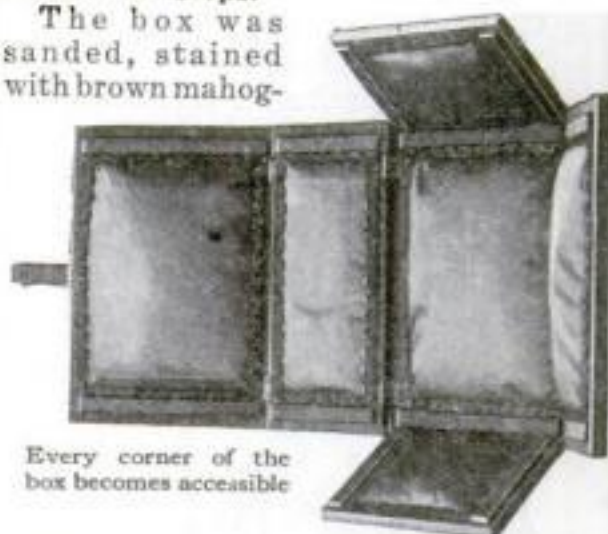


How the trinket case appears when closed

screwed to the top surface of the bottom and the lower edges of the sides and ends. The top is hinged similarly to the back.

A hasp and brass staple hold the top to the front when the box is closed. Small brass dowels and mating sockets aid in holding the end wings from falling outward, and a set of dowels in the front and top further assist in keeping the whole rigid. Strips  $\frac{1}{4}$  in. square are glued in as shown for stops.

The box was sanded, stained with brown mahog-



Every corner of the box becomes accessible

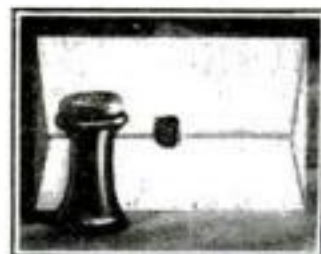
any wood dye, and given a satin surface with wax well rubbed in. The inside was stuffed and covered with old-rose satin, the edges being finished with old-gold braid.—CHARLES M. GREEN.

ANY shade of light-gray enamel can be obtained by adding minute amounts of artist's black oil-colors to white enamel.

#### How to Cut Your Initials in a Sealing-Wax Stamp

A SEAL for impressing your initials in a sealing-wax may be made easily. Melt some lead in a well-greased square or oval tin. Remove the lead when cool and trim it, if necessary, to an oval shape. From a piece of soft wood, whittle a handle. Drill a hole in the lead casting and in the handle to take a tight-fitting wooden dowel.

Place the handle in a vise and transfer on



The stamp and the seal on an envelope

(Continued on page 101)



Price  
\$1.75

Complete with aerial, ground wire and single headphone

\$5.00

with double headphone

\$7.50

**HOWE**  
**Radio Receiver**  
— A Practical Crystal Set —  
for a Worthwhile  
Christmas Present

"GROWN UPS" as well as the "Young Folks" will appreciate the HOWE—especially in homes where there is no Radio or where an extra Head Phone Set can be used independently. The HOWE brings in loud and clear all stations within a 25 mile radius and has good selectivity. Installation very simple—complete instructions furnished.

250,000 now in use.

If your dealer is "out" we will ship either the Receiver alone or one of the "Complete Sets" on Receipt of price.

**Howe Products Co.**  
130 N. Green Street Chicago

### A new Parks!

Cabinet  
Shop Special

No. 7

\$250



#### Make a real shop in your basement

This handy Parks woodworker is complete shop equipment in itself. With it you can do all sorts of cabinet work. Make toys, furniture, radio cabinets—anything. Built for close, accurate work, yet small enough to fit in a corner of your basement. Operates from light socket. Has motor rip and cut-off circular saw, jointer and bandsaw. Add lathe and sharper at slight extra cost. A real machine ideal for home use. Send for circular.

**The Parks Ball Bearing Machine Co.**

1547 Knowlton St., Cincinnati, Ohio  
Canadian Factory: 200 Notre Dame East, Montreal, Canada

# PARKS

WOODWORKING MACHINES



## The Home Workshop

### How to Add a Wide Planing Stop to Your Bench



Even very wide and thin pieces can be planed easily with the aid of this stop

AT THE end of my workbench I have a combination bench stop and saw vise that is of constant service and yet cost little to make.

Two  $\frac{3}{8}$ -in. 3-ply boards were glued together to form a very strong board that can be depended upon to stay flat. This was slotted and fastened as shown to the left end of my carpenter's bench by means of two large wing bolts with washers under the clamping handles.

The stop can be adjusted so as to extend just a trifle above the bench and therefore will serve as a bench stop when



The stop also can be raised and used as part of an improvised saw-filing vise

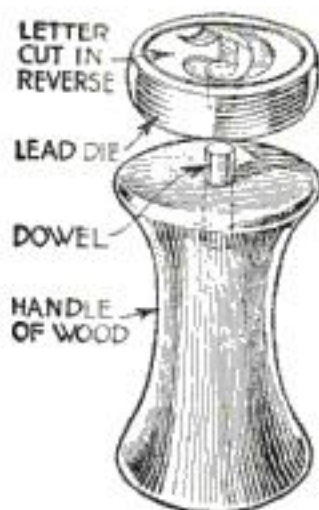
even the thinnest boards are being planed.

When raised and backed with another board, it acts as a rigid, convenient and always handy saw-filing vise.—GORDON H. SEARS.

### A Sealing-Wax Stamp

(Continued from page 100)

the lead the initial or letters from a sheet of tracing paper turned face



The lead stamp and its wooden handle

down to reverse the pattern. With a sharp-pointed penknife cut the reversed initial in the lead and cut a groove around theseal as shown.

In placing a seal on an envelope, drop a bit of melted sealing-wax on the flap and before it cools, press the die into the wax.—CLYDE E. VOLKERS.

## American Flyer

MINIATURE TRANSPORTATION SYSTEMS

ELECTRIC  
and  
MECHANICAL  
RAILROADS

No. 1434—Complete Train Outfit as illustrated with all Accessories and Transformer delivered...\$59.00.

No. 1433—As illustrated above, consists of 15 in. locomotive, 16 in. combination mail and baggage car with mail bag catcher and bags, 16 in. Pullman and 16 in. Observation Car. 8 pieces curved and 6 pieces straight  $2\frac{1}{4}$  inch wide gauge track. Train length 61 $\frac{1}{2}$  inches, track 212 inches. Cars have double lights. Locomotive has double headlights that reverse. Price, Prepaid...\$33.50.

No. 1432—Same as above, without Observation Car. Locomotive has one headlight. Length of train 46 $\frac{1}{2}$  inches, 8 pieces curved and 4 pieces straight  $2\frac{1}{4}$  inch wide gauge track. Length of track 184 inches. Price, prepaid...\$26.00.

## The Boys of America Designed This Train

### The "ALL AMERICAN"—a New Wide Gauge Electric

When we started to build this NEW FEATURE TRAIN we asked hundreds of boys what they would like to have in a WIDE GAUGE Electric Train, that's why we say: "The Boys of America Designed This Train" because we have put into it just the "features" which make it the logical "first choice" of any boy who knows what a Big Electric Train should be like.

#### Exclusive Features of the "ALL AMERICAN" Wide Gauge Train

1. Automatic Reverse.
2. Automatic Headlights, reverse as train reverses.
3. Heavy Steel underframe with unbreakable cow-catcher.
4. Real Automatic Couplers.
5. Two Electric Lights in cars.
6. Dome Light on car platform.
7. All cars lithographed on heavy steel (not painted).
8. Automatic Mail Bag Catcher with bags.
9. Car Roofs removable.
10. Vestibule Spring Doors, four sliding doors on baggage car.
11. Lowest Voltage Motors made, economical to operate.
12. Universal Track Terminal for accessories.

Most of these features are patented

### There Are Lots of Other "American Flyer" Models

Sturdy Mechanical Trains for the smaller boys—"0" Gauge Electrics that any boy would be "tickled pink" to own—each the best in its class.

Show this advertisement to your toy dealer. Ask him to show you the new big "American Flyer"



**Train No. 1221**—(No. 0 Gauge Track). Heavy pressed steel electric engine with headlight, 8 inches. Complete as shown, including tunnel, station, semaphore and automatic mail bag catcher. Double truck cars with disappearing couplers, 6 $\frac{1}{2}$  inches. Baggage car has sliding doors. Passenger car and observation car have interior electric lights. Eight pieces curved, six pieces straight track. Length of train 31 inches. Length of track 142 inches. Weight 10 $\frac{1}{4}$  pounds. Price.....\$12.25

**Train No. 13**—Engine 7 inches. Equipped with piston rods and brake. Cars 5 $\frac{1}{2}$  inches. Baggage car has sliding doors. Ten pieces curved, two pieces straight track, two switches. Length of track 160 inches. Length of train 25 inches. Weight 5 pounds. Train can be switched from large oval to small oval by opening or closing both switches. Price.....\$4.25



Ask at the Toy Stores to see all the "American Flyer" Models—if you can't find the Outfit you want we will send you one from the factory, postpaid, on receipt of price.

Our New 4-color Catalog is ready—it's quite an expensive book but we'll be glad to send you one. Just send us 4 cents in stamps to cover cost of mailing.

American Flyer Mfg. Co. 2237 South Halsted St., Chicago





## here's your hammer!

From the "Never Slip" Handle to the famous Cheney "Wedge" that keeps the head always tight, it's a real tool for a real job: Just enough crown to the face to insure clean work and no hammer marks, just the right sweep to the claws to make nail-pulling easy and a "hang" that you'll find in no hammer except a Cheney.

Behind it all there's 90 years of experience and an unqualified guarantee to replace without cost any Cheney Hammer that proves defective.

### The Home Workshop

#### Bottle Crowns Form Durable "Spikes" for Hiking Shoes

**G**YMNASIUM or ordinary walking shoes can be given the equivalent of spikes by fastening three bottle crowns or caps to each sole. A long trial has shown that the crowns, light as they are, last as long as steel spurs. At the same time the shoes are more comfortable because the area of contact between the crowns and the sole is enough to give the wearer a feeling of balance.

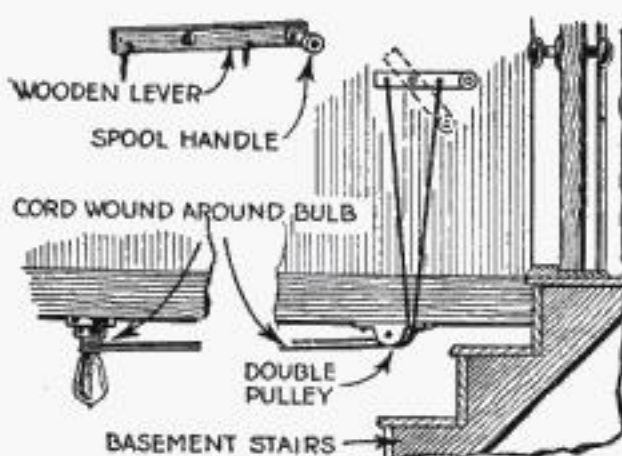


For some reason shoes fitted with the caps do not clog up with dirt or grass to the extent that regulation hiking shoes do. Several of my friends also found last winter that the crowns proved superior to ice creepers costing as much as 75 cents a pair. Any shoemaker will fasten them on.—JOHN H. SCHALEK.

#### Simple Mechanical Substitute for Cellar-Light Switch

**I**N MANY old houses, where the cellar light cannot be turned on and off from the top of the stairs, it is a problem to know how to arrange a suitable control, especially to those who do not own the property in which they live and do not wish to go to the expense of having an electric switch installed. The mechanical control illustrated is a substitute device that will give satisfactory service if properly adjusted.

The switch proper is a flat piece of wood with a spool or knob on one end, pivoted



Moving the lever revolves the lamp bulb and turns the cellar light on or off

about a nail or screw at the cellar entrance. To one side is fastened the end of a piece of string, twine, or flexible cable, which then passes through one side of a double pulley. In the absence of a pulley, screweyes may be used as guides.

The string or twine is wrapped four times around the electric-light bulb and returned through the pulley to the other side of the switch. Merely move the switch arm when a light is required. This screws the bulb in the socket sufficiently to turn the light on or screws it out to turn it off.—J. F. HARDECKER.

This Scientific Device is easily attached to Furnace Door

### CROWN FUEL SAVER and SMOKE ABATER



Mix red hot oxygen with coal gases over furnace fire bed and

**Save 20% on your Coal Bill**

That is the CROWN'S fuel saving guarantee—20%—but it often saves much more! This scientific device is easily installed on the furnace feed door. It will give you balmy warmth from your heating plant and save you many dollars in fuel. Its savings soon pay its cost.

#### Less Coal—More Heat!

The CROWN brings the fire to the top—where it belongs and will do most good. It mixes a supply of **RED HOT OXYGEN** with the smoke gases—completes combustion—gets a greater amount of heat from fuel consumption—greatly aids in abating smoke.

#### 10 Years Successful Use

Thousands now in use and every CROWN is pleasing its owner. Once installed on your furnace you would not be without it. Cheaper grades of coal can be used advantageously. Absolutely automatic—no moving parts.

#### Write for Description

Just issued a full detailed description of the CROWN—write for it today! Contains valuable information for every one buying fuel for dwelling or industrial plant.

**DISTRIBUTORS WANTED!** A splendid business opportunity for live distributors who want sales rights on a permanent, staple article. Your territory may be open—write at once.

**CROWN FUEL SAVER CO.**  
112 N. 10th Street, Richmond, Ind.

Sole Canadian Distributors:  
33 St. Vincent Street, Montreal, Canada

### NEW CARTER "DIALITE"



**\$1.75**  
Complete with Lamp

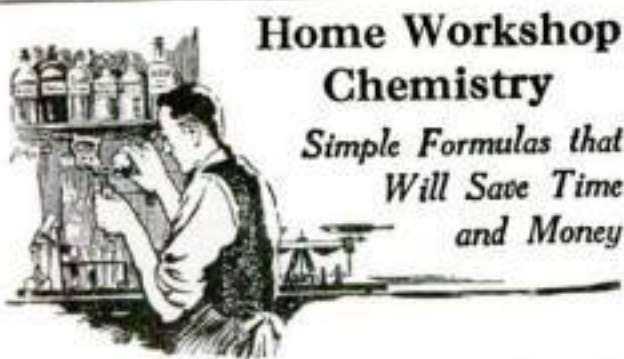
For lighting dials—makes logging surer and simple. Can be used as battery switch in addition to lighting dials. Operates on 6 or 4½ volts. Battery consumption negligible. Quarter turn snap switch, single hole mounting. See one at your dealers. Write us for illustrated folder on other Carter products.

**W. A. Carter** In Canada: Carter Radio Co., Ltd., Toronto

**Carter Radio Co.**  
100 N. LAUREL AVENUE  
CHICAGO, ILL. U.S.A.

**1926 CATALOG JUST OUT!**  
**SEND FOR YOUR COPY**  
**RANDOLPH RADIO CORP.**  
159 N. UNION AV. Dept. 3 CHICAGO, ILL.





## Home Workshop Chemistry

*Simple Formulas that Will Save Time and Money*

**Y**OU can etch without difficulty all kinds of marble and limestone, as well as the various types of slate. The process used is like that of metal etching except that the etching solution consists of 10 parts of water and two of hydrochloric acid.

There are two ways of preparing the stone. If it is large, cover the part to be etched with paraffin and build a ring from  $\frac{1}{4}$  to  $\frac{1}{2}$  in. high around it so as to form a little lake for the etching fluid. If the object is small, cover it entirely with wax so that it may be dipped bodily into the etching fluid.

Before the wax is applied, the design may be drawn in pencil on the stone; the lines will be visible through the thin coat of wax. The wax must be scraped away wherever the lines are seen. Every fragment of wax must be removed from the lines and areas that are to be bitten in by the acid. On the remainder of the surface, however, the protecting wax must be left intact and unscratched.

The stone now is ready to be placed in the acid, or the acid can be poured into the dam prepared for it. The acid should attack the stone neither too vigorously nor too slowly. When the bubbles form too fast, add a little water; when too slowly, add a few drops of acid. After the acid has eaten into the stone to a depth of about  $\frac{1}{32}$  in., wash the stone in running water.

The parts that have been eaten away will appear dull. If desired, these etched surfaces may be made smooth like the unetched parts by placing the stone for a few moments in a hot acid bath.

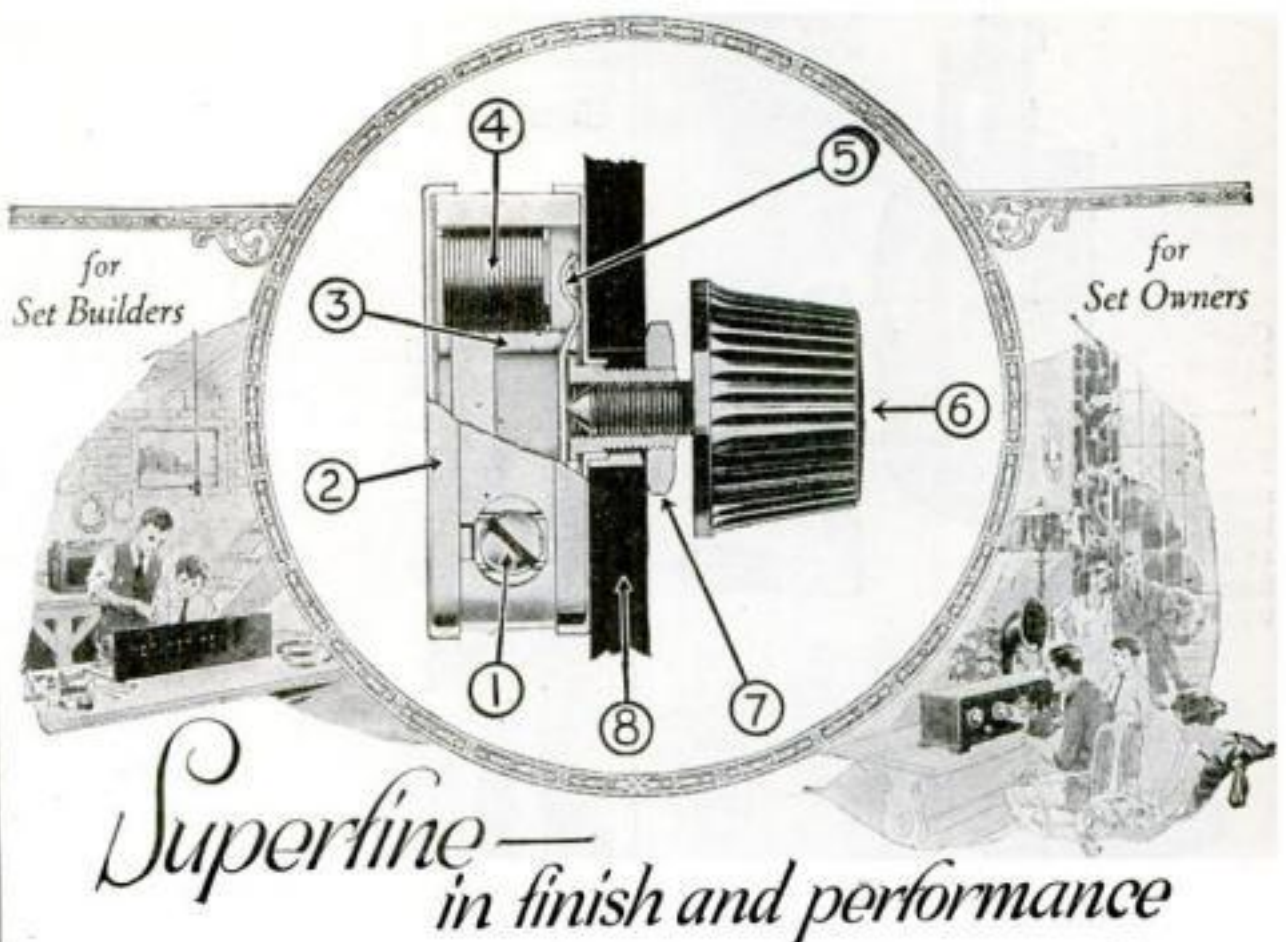
Collar and cuff buttons and other buttons made of bone and horn also can be etched with monograms or small designs. The entire object is coated with paraffin and the design engraved on the wax as previously described, care being taken to remove the wax completely wherever design is to be etched.

In this case the etching fluid consists of 10 or 12 parts of water, to which one part of sulphuric acid has been added. The etching process requires from two to five minutes.

**W**HEN your fountain pen runs dry and you have no way of filling it, usually you can obtain a supply of writing fluid simply by filling the tube about half full with water. As a rule, there are enough ink crystals in the tube to make a fairly good writing fluid.



Bone button etched with script initials



*Superfine—  
in finish and performance*



Bradloystat—Perfect Filament Control for all Tubes



Bradley leak—Perfect Grid Leak  $\frac{1}{4}$  to 10 Megohms



Bradleyohm—Perfect Adjustable Resistor



Bradley unit—Perfect Fixed Resistor

**W**HETHER you build your own radio receiver or buy a factory-built set, you will improve your set by installing Allen-Bradley Perfect Radio Devices. Not only are Allen-Bradley Radio Devices strikingly beautiful in finish and design, but their marvelously silent, selective control never fails to amaze and delight you. The eight salient, unrivaled Allen-Bradley features are:

- 1 Terminals are readily accessible. Designed for bus bar wire or terminal lugs.
- 2 Metal parts are heavily nicked and buffed to a high polish.
- 3 Container is made of glazed porcelain that excludes moisture.
- 4 Specially-treated graphite discs give amazingly wide and noiseless control.
- 5 Internal switch opens battery circuit, if desired, by turning knob to the left.
- 6 Highly polished bakelite knob is removable if you prefer to match other dials.
- 7 One-hole mounting makes installation simple and easy on all sets.
- 8 Can be used with any panel thickness. Back panel extension is extremely small.

Mail the Coupon for Booklet

**Allen-Bradley Co.**

ELECTRIC CONTROLLING APPARATUS

293 Greenfield Ave. Milwaukee, Wis.

Mfrs. of Graphite Disc Rheostats for over 20 Years



Bradleyometer—Perfect Potentiometer

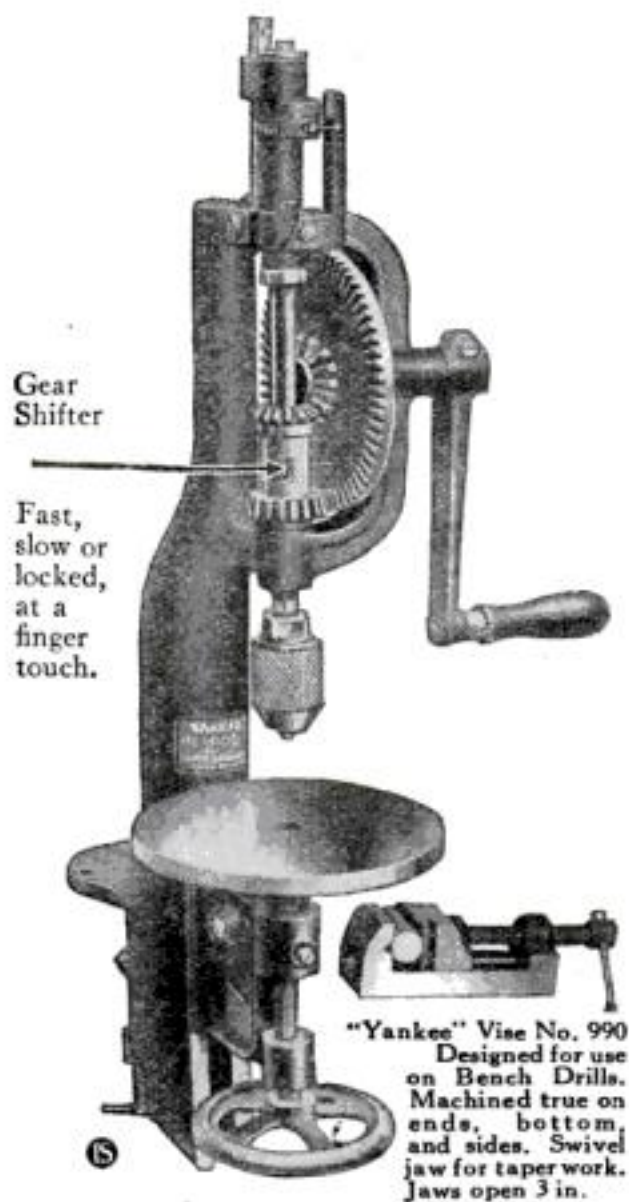
USE  
ALLEN-BRADLEY  
PERFECT  
RADIO  
DEVICES

ALLEN-BRADLEY CO.,  
293 Greenfield Avenue,  
Milwaukee, Wisconsin

Please send me your latest literature on the complete Allen-Bradley line of Perfect Radio Devices.

Name .....  
Address .....





## Think of the drills you save

The Automatic Ratchet Feed on the "Yankee" Bench Drill gives an absolutely even pressure. Takes the place of hand-feeding. Saves drills and time. Just turn crank. Friction Feed runs drill down to work. Then Ratchet Feed operates.

Accident-proof! Automatically knocks off Ratchet Feed at end of upward and downward movement, preventing jamming, stripping, or broken gear teeth.

### "Yankee" Automatic Bench Drill

No. 1005 (illustrated) Two speeds; 3 jaw chuck holds drills up to  $\frac{1}{4}$  in. Entire length, 28 in.  
No. 1003 Single speed; 3 jaw chuck holds drills up to  $\frac{1}{4}$  in. Entire length, 18 $\frac{1}{4}$  in.

#### "Yankee" Christmas Suggestions

No. 30-A Spiral Ratchet Screw-driver  
No. 41 Automatic Push Drill  
No. 1555 Ratchet Breast Drill  
No. 1431 Radio Drill  
No. 1992 Vise with Swivel Base  
No. 2100 Ratchet Bit Brace  
Nos. 105 & 106 Radio Tool Sets

The gift of "Yankee" Tools for Christmas is sure to be appreciated. Ask your hardware dealer to help you in your selection.

"Yankee" on the tool you buy means the utmost in quality, efficiency and durability

Dealers everywhere sell "Yankee" Tools

NORTH BROS. MFG. CO., Philadelphia, U. S. A.

# "YANKEE" TOOLS

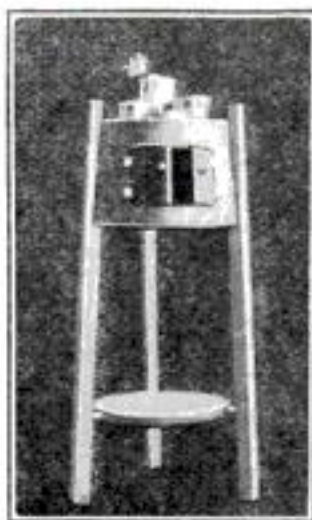
Make Better Mechanics

## The Home Workshop

### Unusual Smoking Cabinet Made from a Candy Pail

BY MAKING use of a candy pail I was able to construct the novelty smoking-stand illustrated for less than one dollar.

Three pieces of wood  $\frac{1}{8}$  by  $1\frac{1}{2}$  by 30 in., a board from which to cut the lower shelf, which is  $11\frac{1}{2}$  in. in diameter, and the candy pail with 3 in. of the top sawed off, were the materials required.



A novelty stand for the man who smokes

Two staves were cut out with a keyhole saw to form doors and then fitted with small brass hinges and brass knobs. A sheet of heavy cardboard glued and tacked in place about 1 in. from the lower edge of the pail serves as the bottom of the cabinet.

The three legs were sawed at the upper ends to suit

the angle of the pail and fastened with glue and screws. The shelf was fastened to the legs with dowels 7 in. from the floor, but it could have been screwed in place just as well.

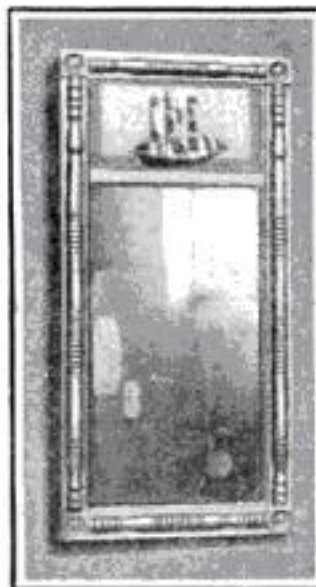
After staining, the cabinet was waxed. An oil or wax finish is better for this type of novelty furniture than varnish. The smoking set on top is of brass to match the hardware.—D. C. BURK.

### Discarded Mirror Remodeled to Resemble Costly Antique

THIS charming copy of an old-style mirror was constructed almost entirely from discarded materials. The mirror itself long had lain in the attic. Its plain frame was decorated with half turnings that were obtained by splitting the legs of an old high stool. The corner blocks were carved from old pieces of wood found lying about the shop.

At the top was placed a photograph of a ship colored with photograph oils and surrounded with a border of black-and-gold paper. When covered with glass it was difficult to distinguish this picture from an original oil painting.

The frame was given two coats of flat paint and then covered with bronze powder in thin varnish. This was distributed evenly by "pouncing" it on to avoid any brush marks.—HAROLD B. SCHOTT.



Mirror frame enriched with half turnings



Screw-driver, wrench, pliers—and a Luther Vise—these are the four "aces of tools" that every mechanical tinkerer should have in his layout. A Luther Vise actually makes your other tools more efficient—and makes every job easier. You'll find a new pleasure in tinkering, once you acquire this "fourth ace". It's a little beauty for looks, as well as service.

Sturdy and compact. Feed-screw nut is solid brass instead of cast iron. Accurately machined feed-screw is over-size. Panelled slide bar extra heavy. Jaw opening wider than any other vise of same size. Four handy sizes— $1\frac{1}{2}$ ", 2",  $2\frac{1}{2}$ ", and 3" jaw opening. Sold by most good hardware stores.

Write for free copy of booklet "Tighten Up"

LUTHER GRINDER MFG. COMPANY  
Department A, Milwaukee, Wis.  
Also manufacturers of Luther Tool Grinders.

# Luther

QUALITY-BUILT VISES

### STOP LEAKS! REPAIR BREAKS! MAKE LOOSE PARTS STAY TIGHT!

#### Smooth-On No. 1

STOPS leaks and repairs breaks in pipes, furnaces, radiators, tanks, bursted water jackets, etc., with one simple application.

Keeps bolts, nuts, grease cups, etc., from loosening and dropping off—makes loose handles tight—joins wood, metal or glass to each other tightly—holds on iron, brass, lead, aluminum, etc.

For quick, cheap, lasting joints and repairs and stopping many nuisances in every home, automobile and workshop, Smooth-On is in a class by itself.

Get Smooth-On No. 1 in 7-oz., 1-lb. or 5-lb. tins at any hardware store.

SMOOTH-ON MFG. CO.  
Dept. 58  
574 Communipaw Ave.  
Jersey City, N. J.

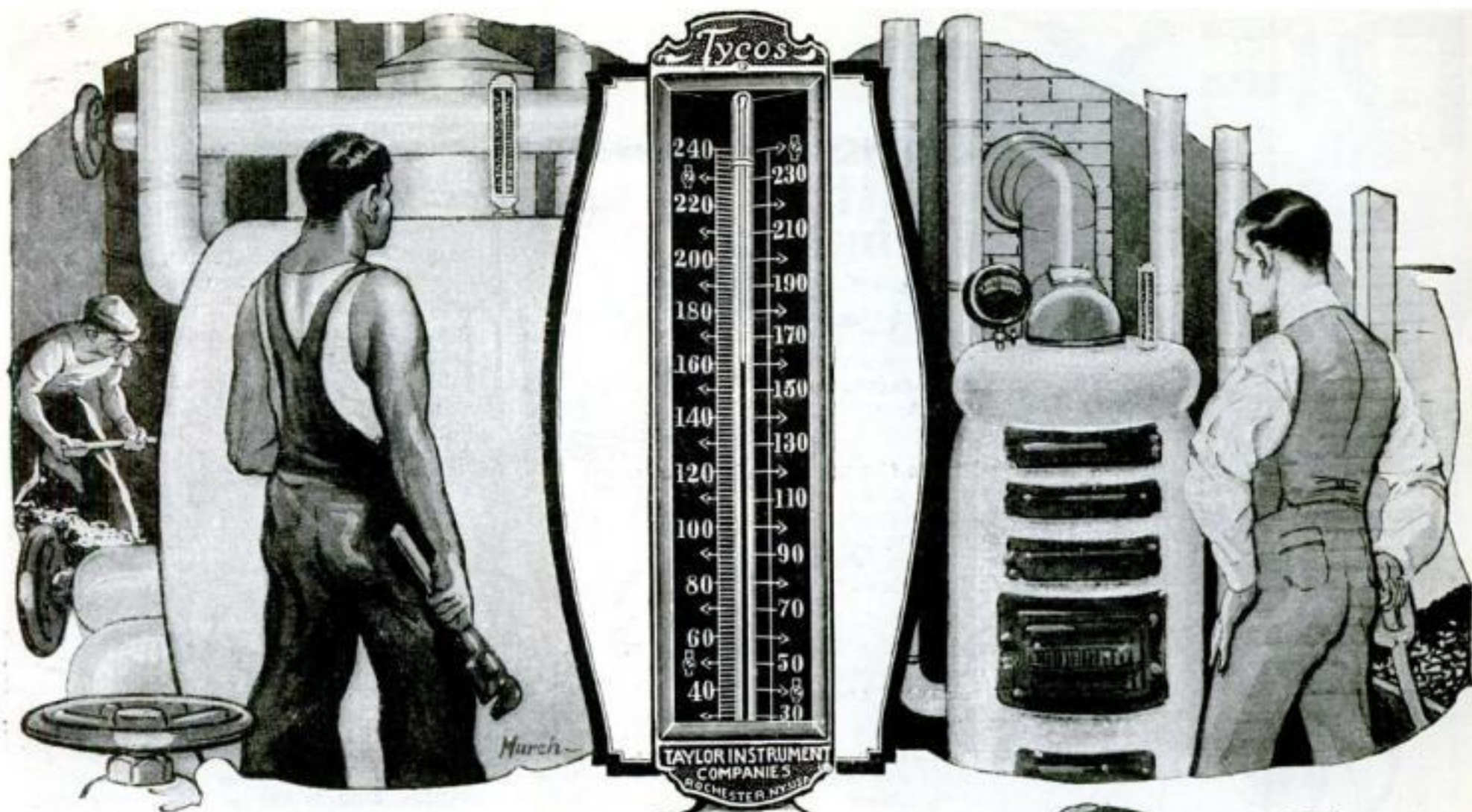
144 pages  
This Book  
FREE

SMOOTH-ON  
REPAIR  
BOOK

## Getting Ahead?

Read the advertisements on Pages 138 to 166 this issue if you want to get ahead!





## For a 2000 Room Hotel —or a 5 Room Cottage

THE controlling of heat is one of civilization's greatest triumphs. Whether it is a matter of physical comfort—keeping warm bodily—or controlling heat in manufacturing processes, the exact regulation of heat is of the utmost importance.

In the great hotels and office buildings, with their thousands of tenants, the engineers have to keep constant watch over the temperature of their boilers to insure satisfactory temperature in the acres of rooms they are responsible for.

**Tycos** Heat Indicating, Recording and Controlling Instruments—the Sixth Sense of Industry—stand watch, night and day, to insure the uniform heat required. With a **Tycos** Thermometer on your private heating plant you can always gage accurately the heat of the boiler in your home.

Whether you make piano wire or mighty cables for bridges, metal toys or steel girders, whether you bake bread by the mile, pasteurize milk by the carload, pack tons of meat, wherever you use heat in your manufacturing, it will pay you to learn how other manufacturers are using **Tycos** Instruments to get the uniform results that are absolutely essential to manufacturing on a volume basis.

### To Manufacturers

In the **Tycos** Line of 8000 different kinds of Heat Indicating, Recording and Controlling Instruments there are instruments that will help you take the guess out of your manufacturing problems. It will pay you to learn how other manufacturers are using the Sixth Sense of Industry to get uniform results. Informative literature on any type of instrument will be sent you on request. Or our engineer will consult with you on the application of **Tycos** to your particular manufacturing process.

### Taylor Instrument Companies

SHORT & MASON, LTD.  
Manufacturing Distributors  
in Great Britain.

Main Office and Factory  
ROCHESTER, N. Y. • • • U. S. A.  
Canadian Plant: **Tycos** BUILDING, TORONTO



## Tycos— for the Home

**Tycos** Office Thermometers  
An aid in promoting human efficiency.

**Tycos** Bath Thermometers  
To enable you to get the most good from your bath.

**Taylor** Home Set  
Bake Oven Thermometer, Candy Thermometer, Sugar Meter. The secret of accurate results in cooking.

**Tycos** Wall Thermometers  
To help you maintain a temperature in your house conducive to good health.

**Taylor** Quality Compasses  
To show you the right way in unfamiliar country.

**Tycos** Fever Thermometers  
A necessity in every home.

**Tycos** Stormoguide  
Forecasts the weather twenty-four hours ahead with dependable accuracy.

**Tycos** Hygrometer  
To enable you to keep the humidity of the atmosphere in your home correct at all times.

Your dealer will show them to you. Ask us, on a postal, for booklets on any of the above.

## Tycos— for the Medical Profession



**Tycos** Sphygmomanometer, Pocket and Office types.

**Tycos** Urinalysis Glassware.

**Tycos** Fever Thermometers.  
Bulletins on request.

THE SIXTH SENSE OF INDUSTRY  
**Tycos Temperature Instruments**  
INDICATING • RECORDING • CONTROLLING





# REX

**for your 'B' battery eliminator**



**REX** answers the eliminator problem. The B battery eliminator equipped with Magnatron Rex tubes works day in and day out—silently and economically.

Magnatron Rex is the product of long research by the oldest exclusive manufacturers of thermionic valves in the country. It has been designed primarily and only for eliminator work.

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Write for **FREE** copy of "Pot Pourri—A review of mirth and music" to Dept. S, Connewey Electric Labs, Magnatron Building, Hoboken, N. J.

West Coast supplied from complete stocks carried by Pacific Radio Labs, 236 So. Los Angeles St., Los Angeles, Calif.



## MAGNATRONS

**SEE—**  
the big Prize Offer on  
page 4 of this issue



**For This Latest Model Imported Jewelled Movement Watch Runs 8 Days with One Winding**  
Only a down payment of 10c required and we make immediate shipment of this beautiful and serviceable watch.

**WE TRUST YOU**  
Shipment Same Day  
No References Needed

Elsewhere you would probably be required to pay upwards of \$16 for a full-jewelled open face 8 Day watch of this quality. Our price reduced to \$12 and you may pay it \$1 per week.

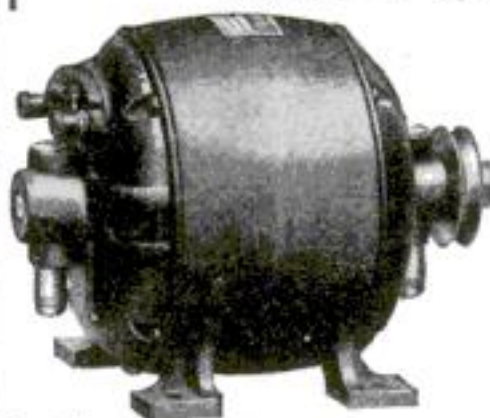
Make first payment only to postman when he delivers package.

Send name and address at once. Our money back watch guarantee protects you.

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**NORTHWESTERN ELECTRIC CO.**  
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### The Home Workshop

#### Mounting Magazine Prints on Fiber Wallboard

**H**OW often have you wished for an easy and effective way of mounting beautiful magazine prints, covers, or colored supplements? One of the best methods is to paste them on fiber wallboard, which can be obtained in large sheets at a reasonable price from any lumber dealer.

The best effect is obtained, as a rule, if the mount



Bronzing a mount

is cut so that it is not very much larger than the picture, just as a narrow, plain picture-frame is usually in better taste than a wide and ornate one.

Prepare a thick paste by mixing 1/2 cup of flour and 1/2 cup of water. Coat the back of the print evenly and fasten it on the wallboard. Then give the wallboard margin around the picture a coat of paste. When this is dry, paint the margin and edges with gilt or bronze. Let this dry thoroughly and then dab it lightly in places with artist's brown, green, and blue oil-colors. Rub and blend the colors with a rag to give a soft, subdued polychrome tone to the mount.

—GEORGE A. PHILLIPS.

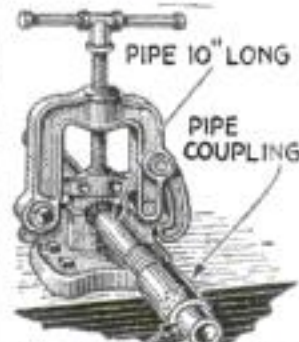
#### Threading Short Pipes

**W**HEN it is necessary to thread a very short piece of pipe or a nipple, the average home worker is puzzled as to the best way of holding the piece, as a pipe die usually is quite thick. The short pieces can be held quite easily, however, by making a holder from a piece of pipe about 10 in. long with an extra long thread and an ordinary pipe nipple.

If, for instance, you need a nipple 3 in. long, cut a standard thread on a longer piece of pipe and cut off the end 3 in. long. Screw the threaded end into the coupling and draw it up tight, while holding the long end of the 10-in. pipe in the pipe vise. Then cut the thread on the nipple.

When removing the finished nipple from the holder, set the pipe vise on the coupling.

If the bushing in the pipe die is too small to pass over the coupling, it is possible to cut the thread without it or to slide the bushing over the 10-in.-long pipe.



NIPPLE—READY FOR OTHER THREAD



NIPPLE COMPLETED  
A pipe holder



## The Home Workshop

### Decorative Wall Bookshelves

By A. E. Elling

**H**ANGING bookshelves, which recently have regained popularity because of their use by decorators in beautiful modern homes, are relatively easy to make. If a design such as that illustrated below is followed, they have the additional advantage that they can be taken apart quickly and packed flat for shipment. One that I made many years ago has been packed many times and traveled thousands of miles, yet it looks as well today as ever.

Any good cabinet wood such as plain or quartered oak or ash may be used. The parts needed are 2 sides,  $\frac{1}{8}$  by  $8\frac{1}{2}$  by 48 in.; 1 bottom,  $\frac{1}{8}$  by  $8\frac{1}{2}$  by  $32\frac{1}{2}$  in.; 1 top,  $\frac{1}{8}$  by  $6\frac{3}{4}$  by  $32\frac{1}{2}$  in.; 1 shelf,  $\frac{1}{8}$  by  $8\frac{1}{2}$  by 27 in.; 1 shelf,  $\frac{1}{8}$  by  $7\frac{5}{8}$  by 27 in.; and 4 metal mirror plates.

Cut a double tenon at each end of the top and bottom shelves, which are 2 ft.



3 in. long between the shoulders. Make all the cuts square and true, as neat workmanship is especially important in pieces that are not glued solidly together.

In cutting the small mortises for the wedges, be guided by the shape and thickness of the wedges, which should be prepared first. Lay out the ends to suit the shelves as shown, or in any other way you prefer, and mark the scroll design at the top and bottom. Lay out the mortises for the shelf tenons a little larger than would be required for gluing, so that the case will come apart readily.

If you know of a convenient mill having a band or jigsaw, the scrollwork on the case ends and the wedges can be done quickly and cheaply by machine; otherwise you will have to cut them by hand with a fretsaw, turning or compass saw and finish with a cabinet rasp, files, scraper, and sandpaper.

The intermediate shelves have two  $\frac{3}{8}$ -in. dowels in each end. These pro-

(Continued on page 108)

## "I Wonder How He Knows So Much!"

How many men do you know who surprise you by the wealth of their general information and the breadth of their knowledge? If you were to inquire, you would find that nine out of ten of these men make a daily habit of consulting an up-to-date Encyclopaedia. Here they have the knowledge of the centuries—accessible, concisely and plainly stated, easy to grasp and to remember.

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## RADIO ARITHMETIC

For Example

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That's an easy one. They're not far away at all; they're right with you, performing antics on your aerial, trying to make themselves heard.

Give them a real chance by keeping your batteries full of pep. That's another easy one! Just put the job up to a Westinghouse Rectigon.

It's for "A" batteries and "B" batteries; and your automobile battery will get a full kick out of this handsome little helper.

There's no muss or fuss when you use the Rectigon. No acids or chemicals. No moving parts and no noise! It's a high quality Westinghouse Product throughout, guaranteed to make your storage battery radio set satisfying and complete.

WESTINGHOUSE ELECTRIC &  
MANUFACTURING COMPANY  
South Bend, Indiana

Westinghouse manufactures, also, a complete line of Micarta radio panels, Micarta tubes and instruments.

## The Westinghouse

© 1925, W. E. & M. Co.

### Rectigon Battery Charger



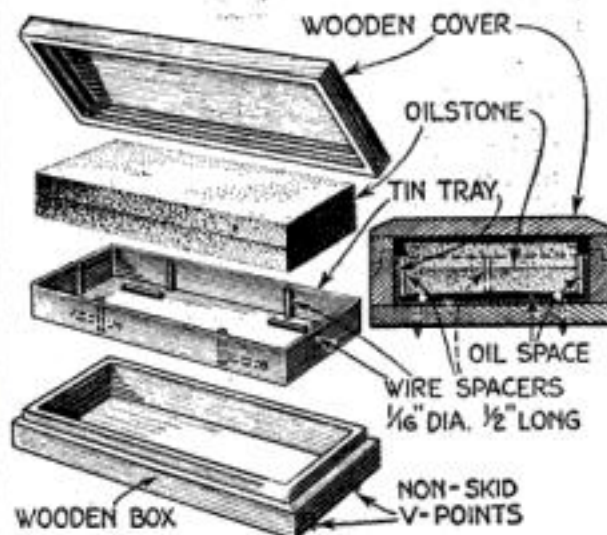
No storage-battery radio is complete without a Rectigon.

## The Home Workshop

### Special Box Keeps Oilstone in Perfect Condition

ALTHOUGH it has been in constant use for 20 years, my soft Arkansas oilstone never has glazed and is as clean as when it was new. The secret is that it is kept moist all the time with machine oil thinned with kerosene.

Oil will creep over the top of a wooden oilstone box, so I formed a heavy tin receptacle over a hardwood block of suitable depth and  $\frac{1}{8}$  in. longer and wider than the stone. Pieces of  $\frac{1}{16}$ -in. brass



The stone rests in a reservoir filled with machine oil thinned with kerosene

wire  $\frac{1}{2}$  in. long were soldered in the pan to separate the stone from the container.

The pan was set in a wooden box with a cover. Two screws were inserted in one end of the bottom and filed to form V-shaped points, which prevent the oilstone from skidding in use. By simply turning the stone over, a clean, oil-soaked surface is always ready.—W. M. BAYRER.

### Decorative Bookshelves

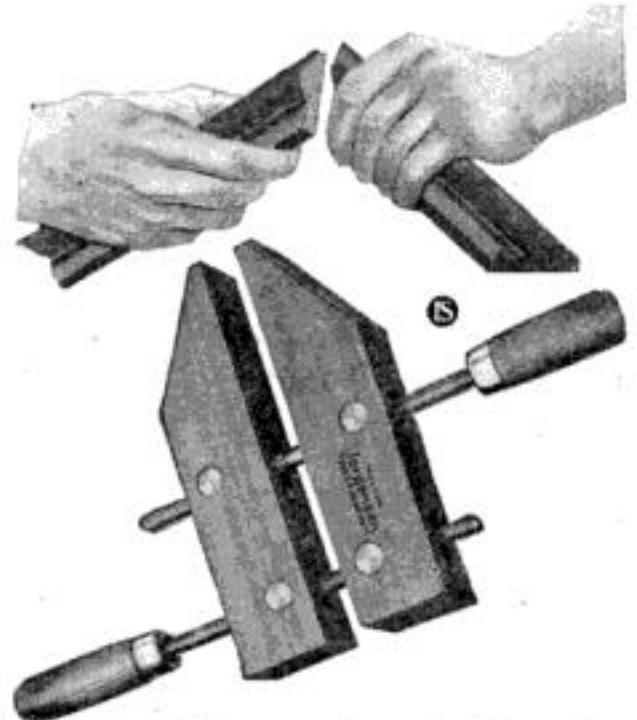
(Continued from page 107)

ject  $\frac{1}{2}$  in. Corresponding holes are bored in the bookcase ends to make the spacing between the shelves, in this instance 12, 10, and 8 in. respectively. This provides room for at least 75 books of varying sizes.

The scrolls and mortises and tenons should be cleaned up carefully with a wood file, scraper, and sandpaper before assembling.

The front edges of both shelves and ends may be beaded, molded, carved, or left plain. The steplike arrangement may be omitted and the shelves and ends made of one width,  $8\frac{1}{2}$  in. The case still will look very well. The construction can be further simplified, of course, by simply nailing or screwing the parts together. The wood may be finished with wood dye, shellac, and wax or varnish.

Mirror plates, to be obtained in most hardware stores, are well adapted for hanging this case. Having decided the position on the wall where it is to go, tap the plaster gently with a hammer to find the location of the wall studs by sounding. Then fasten the mirror plates to the shelves in such positions that the wall screws will enter the studs and not merely the lath and plaster. Four  $1\frac{1}{2}$ -in. No. 10 screws will hold the case. The parts will go in a box 6 by 9 by 4 ft.



## The Handy-Man's THIRD HAND

"I have often been surprised that amateur woodworkers do not make more use of hand screws. They can be put to innumerable uses. They are as useful as a third hand. At least two good woodworkers clamps will be found invaluable for holding material when working it or gluing it up, especially if any furniture making is done in the home workshop," says A. E. Elling in POPULAR SCIENCE MONTHLY.

With Jorgensen Adjustable Hand Screws in your tool chest, you will find scores of jobs that bothered you before can be held together in exactly the position you want with a few turns of the screws.

The Jorgensen Clamps can be adjusted to any angle. This does away with the nuisance of "squaring up" regular surfaces which other clamps require.

The steel screws in the Jorgensen Clamps do away with the warping, swelling, sticking trouble and breakage of wooden screw clamps.

Follow Mr. Elling's tip and include hand screws in your tool kit—be sure they are the Jorgensen Adjustable so you can use them on all shape jobs.

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Adjustable Clamp Co.

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"JORGENSEN"

STEEL SPINDLE HAND SCREWS  
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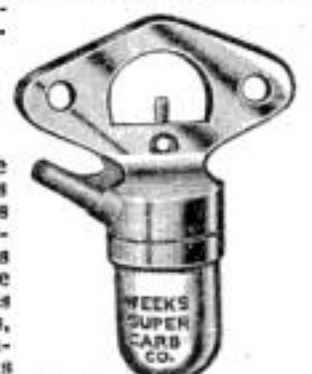
- Please send items checked below:
- ☐ Ship by mail, postage prepaid, ONE No. 5-0 Jorgensen Hand Screw (Length 4 in., Jaw opening 2 in.) for which I enclose \$1.00.
  - ☐ Ship by mail, postage prepaid, ONE No. 0 Jorgensen Hand Screw (Length 8 in., Jaw opening 4 1/2 in.) for which I enclose \$1.50.
  - ☐ Send latest descriptive bulletins.
- Money will be refunded if tools are unsatisfactory and are returned within 30 days.

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Address.....

## Tests Show Ford Can Run 41.4 Miles On Gallon of Gas

The amazing fact that a Ford can run 41.4 miles on a gallon of gasoline was recently brought to light through tests conducted by America's foremost engineers. Great strides have already been made in this direction by the recent invention of a simple attachment which can be installed in a few minutes without any alterations to motor. A. C. Winterburn made 41.4 miles on 1 gallon of gasoline after this device was attached. B. O. Weeks, famous aviator and inventor, wants agents and will send sample for trial. Write him today at 426-1563 Eleventh street, Milwaukee, Wisconsin.





## The Home Workshop

### Spring-Supported Cradle Lulls a Baby to Sleep

By O. M. Salisbury

WHEN the first baby came, we found she slept best on a pillow in one of the old-style rattan baby-carriages. It was balanced so nicely on its springs that if the baby moved, the carriage "jiggled" and often soothed her into slumber again. But the carriage was a clumsy piece of furniture in the bedroom, was not always in the house when needed, and, what was more important, the child soon filled it too full.

We were loaned an old-fashioned cradle with rockers, but, instead of quieting a fretful child in the night, it had a tendency to roll her back and forth unless rocked so very gently that it had no effect at all.



A touch of the hand or even the baby's own movement makes this cradle "jiggle"

This led me to make a cradle incorporating the vibratory idea of the baby-carriage. After raising five babies through cradlehood, we consider it the most satisfactory thing for its purpose that can be made.

The idea is simple and any one able to use tools can work it out easily, with any degree of elaboration desired.

First make a frame or box from 1-in. stock the right size to hold a large pillow or small mattress. The sides can be cut to a curve at the top to give a pleasing effect, and they should be deep enough so that the child cannot roll out—say 10 in. at the foot and 12 at the head.

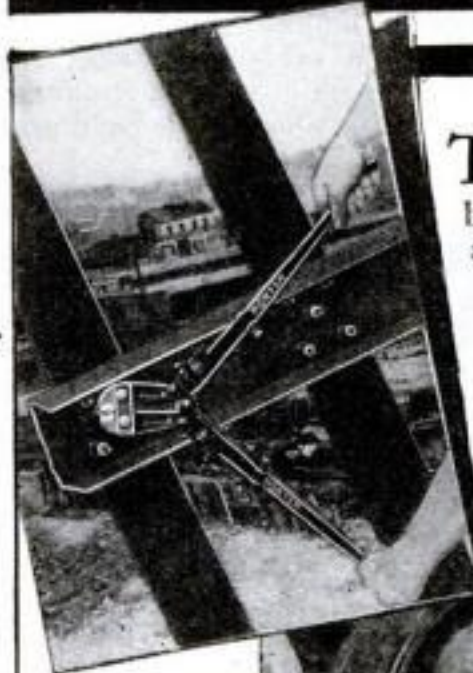
Do not put in a solid bottom, but nail  $\frac{1}{2}$  by 2 in. slats across at 2-in. intervals. They allow ventilation.

Next, make a frame about an inch larger each way, inside dimensions, than the box. Rip a piece of 2 by 4 in. scantling to make the four 2 by 2 in. legs, and make them a little longer than may seem desirable. Use 1 by 4 in. material for the side and end strips and set them flush in the legs, with the side strips on the outside of the legs and the end strips on the inside. To brace the legs further, mortise 1 by 1 in. cross strips into the legs about halfway to the floor.

About 4 in. from the head end, nail or

(Continued on page 110)

# What PORTER'S time-savers do-



THE pictures suggest a few uses. There is not a factory, repair shop, garage or home workbench where a Porter Time Saver does not belong and where it will not be frequently used.

The top picture shows how the Angular cutter gets into the difficult places. Jaws at an angle to the handles so that tool can get into channels, recesses, etc. Very powerful and made in size to cut up to  $\frac{3}{8}$ -inch bolt. One of several types of Porter Clippers.

A Nut Splitter gets the nut off the bolt when wrenches won't turn it. Splits the nut in half so it falls off. Does not cut the bolt. A No. 3 cuts the nut of a  $\frac{3}{8}$ -inch bolt or smaller.



A CHAIN cutter cuts chain, any chain, hard or soft, from  $\frac{1}{8}$ -inch to  $\frac{7}{16}$ -inch size, capacity depending upon size of tool and hardness of chain.

If you use tools, you need one or more of these high-power cutting devices. They cost very little in comparison with the time they save. Jaws of different designs are made to get at work in awkward places. Your tool dealer has or can get them.



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2 Genuine Diamonds 4 / 100 Each

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1. It has made good in two years of the hardest service — automobile factories, for example.
2. It passed with honors the rigorous tests of Popular Science Institute of Standards.
3. It is beautifully finished; you'll be proud to own it.
4. Superior shifting arrangement for right or left spiral, ratchet, or rigid action.
5. 3 blades—3 ways of working—does everything a screw driver can do, and does it easily.

## MILLERS FALLS Spiral Ratchet Screw Driver No. 61

Thousands of leading hardware stores carry No. 61. Ask to see it. No. 62 is the same tool bigger; No. 67 smaller. Nos. 610, 620 and 670 correspond with Automatic Return feature.

### Note these points

Three actions—right or left spiral; right or left ratchet; plain screw driver.

Three blades—easily inserted, with positive lock; easily removed. Special steel, each blade tested individually.

Unique design of shifter; quick and positive action. Locking collar on shoulder of spiral makes it a ratchet screw driver.

All exposed parts highly polished and nicked.

A wonderful tool—new enough to be designed right, old enough to be proved right.

### MILLERS FALLS COMPANY

Millers Falls, Mass.  
23 Warren St., New York  
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Manufacturers of Mechanics' Tools, Hack Saws and Automobile Tools.

**MILLERS FALLS TOOLS**

SINCE 1868

## The Home Workshop

### Decorative Table Constructed by a One-Armed Man

MEN who are crippled severely often find amusement and sometimes profit in light constructive work. The results they accomplish are frequently astonishing. The table illustrated, for example, is the work of Charles Hullinger of Oakland, Calif., who lost his right arm



Table made by Charles Hullinger

just below the shoulder several years ago. In a letter accompanying the photograph he writes:

Being fond of tools and machinery, I have tried to overcome the handicap. I made a jigsaw out of an old sewing-machine and that is what was used to saw the table legs. I finished the piece with a mission stain, one coat of shellac and two coats of varnish rubbed down with oil and pumice-stone. I had no assistance of any kind.

A feat of this kind is a striking indication of what can be accomplished in the home workshop through persistence and enthusiasm.

### Spring-Supported Cradle

(Continued from page 109)

screw a 1 by 6 in. piece on the two side braces, and fix a corresponding strip on the bottom of the box. Support the box inside the frame temporarily so that the 1 by 6 in. pieces are about 8 in. apart and the foot is lower than the head. Fasten the foot of the box to the foot of the frame with two 2-in. butt hinges, screwing one-half of each hinge on the top edge of the end strip and the other flat against the footboard of the box.

Between the two 1 by 6 in. strips, fasten with staples two or more spiral upholstery springs so that when the pillow, bedding, and babe are in the box, it will be balanced nicely, with the head a little higher than the foot, and will spring up and down easily.

When the rough work has been completed, cut off the legs according to the height of the mother's bed so that when her arm is outstretched, the hand will rest easily on the side of the box. Put castors under the legs, paint the wood-work the desired color, and then enamel it.

Such a cradle is most successful in quieting a restless or light sleeper. The mother soon becomes so accustomed to it that when the babe fusses, she will put out her hand and rock the cradle in her sleep. Even the kicking or turning of the child will start the soothing motion.

## For Christmas an Ingersoll



### The New Yankee

\$1.75

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### Wrist Radiolite

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A serviceable watch for women, boys, girls, sportsmen, motorists, etc.



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are ideal. Get our catalog and select your own.

A postal brings it.

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Cap 4" dia. x 12" length. Slide rest has travel entire length of bed. Lathe screw inside bed. Hollow spindle. Turning, facing, boring, drilling, winding, thread-cutting.

No. 1 Lathe, plain headstock \$28.00

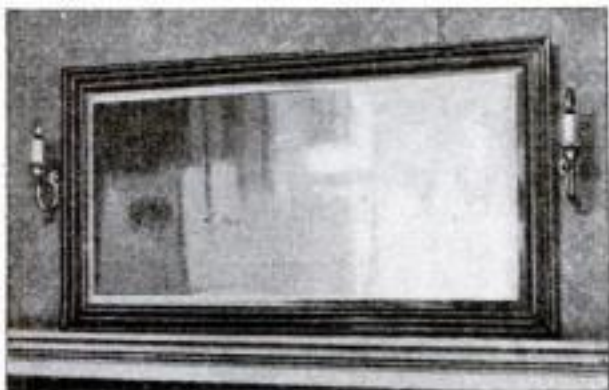
No. 2 Lathe, back-geared headstock \$58.00

Complete line of accessories at equally low prices. New Catalog sent free. THE GEROLD COMPANY Dept. P. S. 6, 120 Liberty Street, New York



## The Home Workshop

### Wiring Miniature Candles for the Mantelpiece

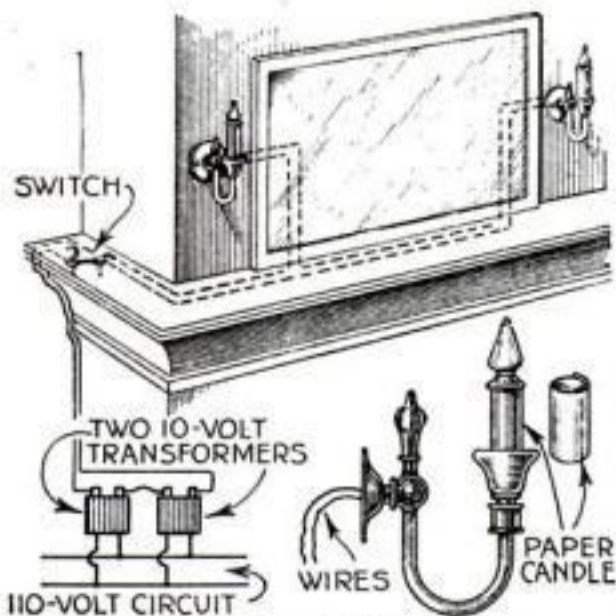


Small transformers furnish the current for these cheap but ornamental candle-lights

FEW homes do not require additional electric wiring after completion. To install the extra wiring often is difficult and expensive, and sometimes impossible.

If the wiring is for purely ornamental fixtures, such as candlesticks over the mantel or in an alcove, it is possible to save expense by using miniature lamps lit by one or more transformers of the type used to operate Christmas-tree lights and toys or to ring doorbells. Ordinary insulated bell wire or double cotton-covered magnet wire will serve for the wiring.

At each side of a mantel mirror I fitted two tubular wall fixtures with ordinary candlestick adapters. Gray stationery paper wrapped around the bases of the adapters forms the candles. Christmas-tree-light sockets fit into the tops of these



Showing how the miniature lamps are made and wired to the light mains

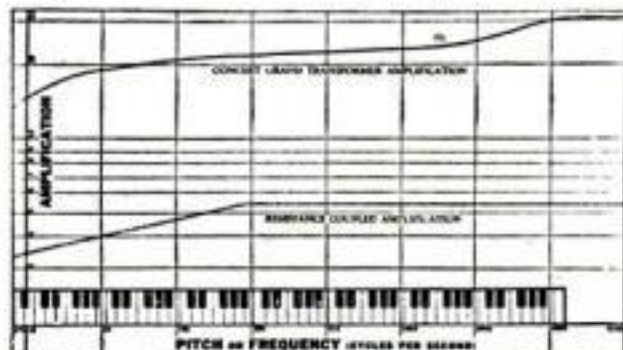
rolled "candles" and carry regular 14-volt yellow flame-type Christmas-tree lights.

The candles are wired in series. A small switch of brass wire and brass screws in the mantel controls the current. The wires run up from the basement through a crack between the wall and the mantel, and up behind the mirror. Two 10-volt bell-ringing transformers are connected in series in the basement. The transformers are inexpensive and may be connected easily with the regular lighting circuit according to the instructions furnished with them.—JAMES DUNN.

THE always exasperating job of soaking and scraping off old wallpaper can be made somewhat easier if half a pint of glycerine is added to each pail of hot water used in moistening the paper.

# ERLA's New Audio Gives Marvelous Tone Curve

Exact laboratory tests show that no other audio gives more perfect reproduction. Note how uniformly and evenly all notes are amplified at frequencies from 32 to 10,000 cycles.



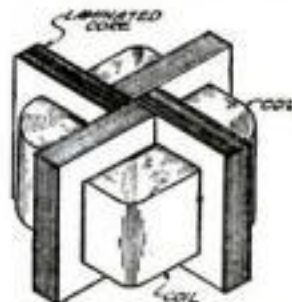
Note the smooth, even progression of the Concert Grand curve, revealing supreme uniformity of amplification, from lowest notes to highest in the musical scale.

AN amazing improvement has been made in audio amplification. A new transformer—the ERLA Concert Grand—gives unusually superior results due to its special system of amplification.

### Amazing improvement

Ordinary designs permit too much leakage to amplify properly at low frequencies. So we use the "quadriform type," heretofore unknown in radio work. In this design magnetic leakage is practically eliminated by providing twice as many paths for the magnetic field and by a better distribution of the core metal around the copper wire coils. Each of the four core units are complete magnetic circuits within themselves without breaks or joints to the main central core, and it will also be noticed that the central core section has a far greater area than conventional core types. The large area thus obtained reduces the effect of the direct "B" battery current on the pulsating voice currents and eliminates a cause of distortion common to transformers using smaller core sections.

The Concert Grand saves you money, too. Resistance coupling depends solely



Note the quadruple core surrounding the coil, forming an almost perfect path for the flux within the coil. The core is a special grade of laminated silicon steel that provides highest permeability and lowest hysteresis loss, with consequent maximum conductivity in the magnetic circuit of the transformer. Price \$10. West of Rocky Mountains, \$10.50.



One-piece drawn steel shell provides perfect magnetic shielding. Finished in black crystalline lacquer and attractive in appearance.

upon the tubes for amplification. Consequently they must be operated at maximum efficiency, requiring more "A" battery current and higher plate voltage—135 to 150 volts. Filaments wear out more rapidly as a result and battery life is more than cut in half. The higher initial cost of Concert Grand amplification is therefore saved many times over, not only in improved performance but also in lowered upkeep costs.

### Booklet sent FREE

Get the Audio Grand at your dealer's today. See what a tremendous difference it will make in your set. If you wish to return the coupon, we will send you a new booklet giving the latest information on audio frequency amplification.

**Electrical Research Laboratories  
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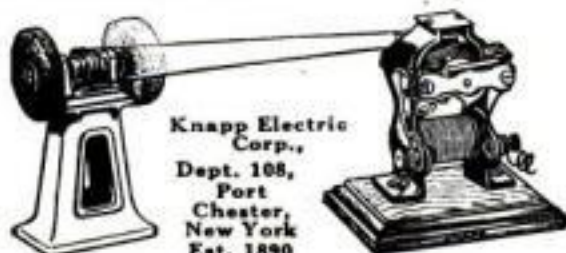
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## The Home Workshop

### Weatherstrips Save Coal

(Continued from page 70)

gether. These strips must be well nailed.

**Cord with Rubberized Covering.** A flexible strip that can be bent at the corners and carried continuously around doors and windows. Applied with 4-oz. copper or trunk tacks spaced about 1 3/4 in. apart. A high-class, durable strip, but as easily handled as felt.

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### Metal Weatherstrip.

This class includes a very large variety of all-metal weatherstrips that interlock in such a way as to

make a window or door almost airtight. Applied according to directions furnished with strips. Sash almost always have to be removed and grooved or rabbeted. Careful and exact workmanship is required, so that amateur mechanics rarely install these strips, although they are the best and most durable in the long run. Most of them are practically invisible. Doors sometimes are provided at the bottom with a strip that is forced automatically down against the threshold as the door closes.

Weatherstrips can be made at home by cutting old automobile inner tubes into strips wide enough so that each can be folded over to form a cushion-like inclosure when it is tacked tight. Another method is to cover cotton rope with canvas, which should be well painted after installation. Still another method is to wind strips of wool spirally around wooden sticks about 1/4 by 5/8 in. in cross section and nail in place like wood-and-rubber weatherstrip.



When applying weatherstrip, see also that all the window lights are puttied thoroughly

### Special Uses for Wallboard

(Continued from page 82)

loose sections of plaster and nail suitable furring strips over the studs to prevent sags in the board at these points. With a fine-toothed saw cut the board to fit around obstructions.

Locate the studs by tapping the wall with a hammer and mark their location on the plaster above the height of the wainscot. To save splicing the wainscot, remove the toilet flush tank by disconnecting the pipes and loosening the screws that hold it to the backing on the wall.

Stand the wallboard on the base and nail into place with sixpenny finishing nails driven into the studs every 8 in. through the depressions marking off the tile. Set the nail heads for puttingty.

When all four sides are up, nail in place

(Continued on page 113)



## The Home Workshop

### Special Uses for Wallboard

(Continued from page 112)

the wainscot cap, which previously has been rabbeted on the lower edge to fit snugly over the wallboard. This cap usually should be not less than  $3\frac{1}{2}$  in. wide, not because a narrower strip would be unsightly, but because the wider affords good backing for towel racks.

If the room is rectangular, put up one long side, and working from left to right, cope each succeeding piece against that already up. If the room has a jog, fit the pieces around the projecting corner last, as a mistake in the last and most difficult joint will mean less waste of material.

**R**UN a back band around the top of the base, mitering it around jogs and nailing into studs where possible.

At one side of each corner nail up a wooden strip  $\frac{1}{2}$  in. thick and  $2\frac{1}{2}$  in. wide. Against this butt a strip 2 in. wide to complete the corner angle. For sanitary reasons the edges are best not molded beyond a slight rounding of the corners.

Over the bathtub place a splash apron of  $\frac{5}{8}$  by 6 in. baseboard, as detailed in Fig. 1. Fit very accurately to the tub, then oil the backs and lower edges of each piece, as well as the corner joint, and coat with thick white lead.

Coat the wallboard and tub as well, so that when the apron is placed it will bed thoroughly in the lead. If this precaution is not taken, no matter how close the joint with the tub is made, water will be drawn under the apron by capillary action and in a short time the wallboard and back of the apron will rot.

Drive the nails in the top first, inclining them downward to draw the board tightly against the tub, so that, in shrinking, the upper edge will move downward instead of the lower edge's rising and breaking open the joint. For the same reason drive the lower nails horizontally and within  $\frac{1}{2}$  in. of the edge. To prevent possible chipping of the tub enamel with the hammer when nailing the splash apron, lay a waste strip of wallboard over the tub.

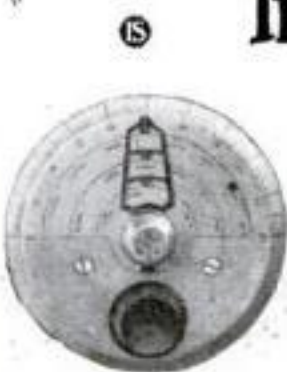
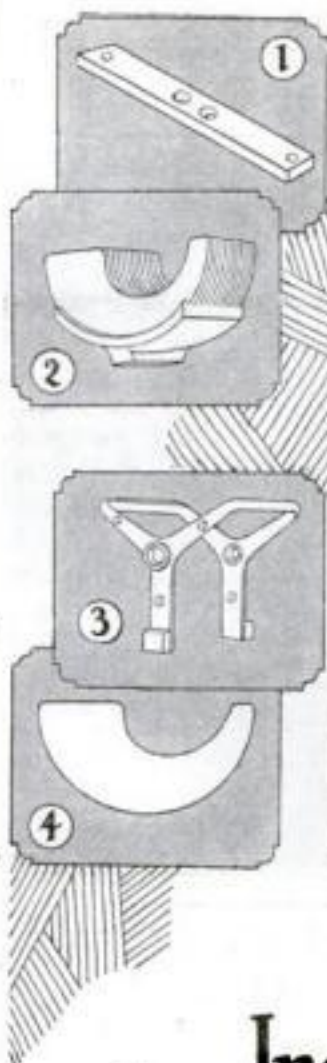
In the same manner tile board may be applied in the kitchen or laundry. Where it cuts against a cabinet, run base shoe or a cove around the cabinet to hide the joint.

Many commonplace rooms may be beautified by replacing the angular joining of walls and ceilings with a cove bounded by simple moldings. Figures 3 and 4 (page 82) illustrate this.

Measure down from the ceiling 1 ft., 6 in. and strike a chalk line level along each wall, by which the lower ends of the brackets are guided. Similar guide lines are struck on the ceiling 1 ft.  $4\frac{1}{2}$  in. from the walls. Locate and mark the studs and ceiling joists.

The brackets are sawed from 2 by 6 in. stock, curved to a radius of 1 ft. 8 in., with the upper ends  $1\frac{1}{2}$  in. wide, and the lower,  $\frac{1}{2}$  in. The lower ends are nailed to the studs, but since ceiling joists and studs often do not line with each other, a strip

(Continued on page 114)



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TUNING CONTROL

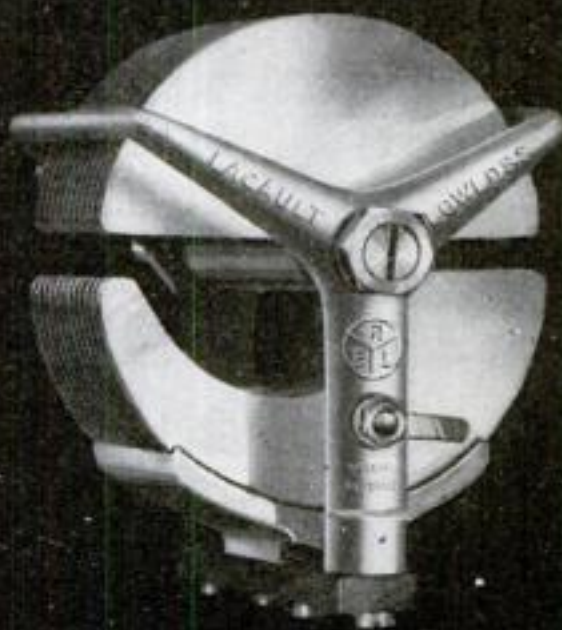
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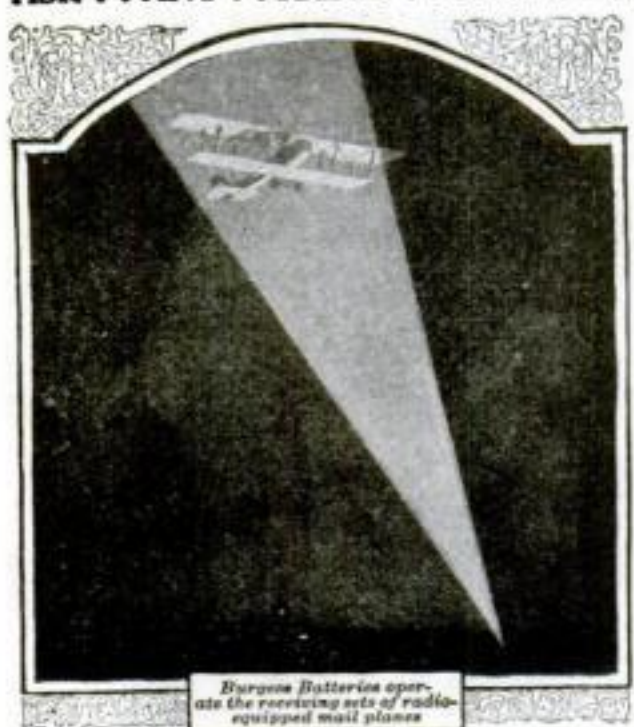
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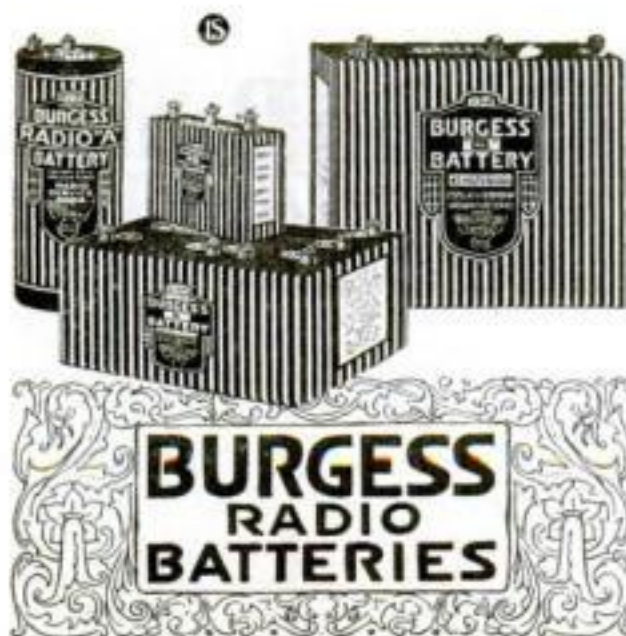
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## The Home Workshop

### Toy Reproduces Every Detail of Large Kitchen Cabinet

PROMPTED by the ambition to make a toy that would be superior in style and finish to anything he could purchase, George Schumacher, of New York, built the miniature kitchen cabinet illustrated. He used Home Workshop Blueprint No. 27 as a guide in obtaining the proportions. As the height is only 34 in., the hardware had to be made by hand.



### Special Uses for Wallboard

(Continued from page 113)

of 1 by 3 in. stock must be nailed to the ceiling, and the brackets notched around it, as shown.

Cut the wallboard 2 ft. 2 in. wide. Tack the upper edge, and with a strip of wood held horizontally, force it gently into the curve. Drive enough nails through this strip to keep it in place, and nail the board at every bracket with fourpenny finishing nails, countersunk. Lastly remove the strip of wood.

The next step is to place the brackets against the end walls. Figure 4 illustrates the development of a more or less triangular shaped section of wallboard to be bent into the corner against the coves already up.

Divide the curve of a bracket into eight equal parts, and placing it on a sheet of paper, as shown, draw two sides of a rectangle, making angles of 45 degrees with the bisector of the curve, the width being 1 ft. 4½ in. and the length eight times the length of one division (A) on the curve. Draw lines from the points on the curves parallel to the long side, intersecting with lines from the eight divisions drawn parallel to the short side. Through these intersections draw the curve. Cut out this pattern and lay out for backing triangles to nail up at the ends of the coves already placed. The edges are accurate forms against which to bend the ends of other coves.

This same pattern is used for laying out the ends of the end coves, which of course are convex rather than concave.

Trim off projecting edges of wallboard and hide the lower edge with a suitable panel mold, under which the picture mold is run, leaving ⅜-in. space for picture-hooks. Run a bead mold in the recess formed by the top, and fit over the corner a bead that will join neatly with the mold.

Somewhat simpler to build is the so-called chapel ceiling (Fig. 5), in which the two sides of the ceiling are sloped for a distance. If desired, this slope can be made on all sides of the room.—E. M. L.

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1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Popular Science Publishing Co., Inc., 250 Fourth Avenue, New York, N. Y.; Editor, Sumner N. Blossom, 250 Fourth Avenue, New York, N. Y.; Managing Editor, Sumner N. Blossom, 250 Fourth Avenue, New York, N. Y.; Business Manager, O. B. Capen, 250 Fourth Avenue, New York, N. Y. 2. That the owners are Popular Science Publishing Company, Inc., 250 Fourth Avenue, New York, N. Y. Stockholders of Popular Science Publishing Company, Inc., Henry J. Fisher, 22 William Street, New York, N. Y.; Oliver B. Capen, 250 Fourth Avenue, New York, N. Y.; Robert Cade Wilson, 68 Springfield Avenue, Summit, N. J.; L. B. Tunison, 6 N. Michigan Ave., Chicago, Ill.; A. L. Cole, 250 Fourth Avenue, New York, N. Y.; Godfrey Hammond, 25 Fourth Avenue, New York, N. Y.; Sumner N. Blossom, 250 Fourth Ave., New York, N. Y.; John Nichols, 25 Fourth Ave., New York, N. Y. 3. That the known bondholders, mortgagees and other security holders owning or holding 1 per cent or more of the total amount of bonds, mortgages, or other securities are: none. 4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner, and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the stock, bonds, or other securities than as so stated by him.

(Signed) O. B. Capen, Business Manager.  
Sworn to and subscribed before me this 26th day of Sept. 1925.  
Joseph Bernstein, Notary Public, New York County, New York County Clerk's No. 170, New York County Reg. No. 6127.  
(Seal) My Commission expires March 30, 1926.



## The Home Workshop

### Automatic Switch Control

(Continued from page 72)

will note a disk with a section cut away drawn in dotted lines. This disk, or rather, segment of a circle, is made of thin brass about 1/32 in. thick. It is screwed with countersunk flat-head brass screws to the under side of the insulating disk. Be sure that the screws are cut short enough so that they will not go clear through the insulation and ground the brass segment on the worm wheel. This is important.

Two brass brushes are mounted on a strip of insulating material, which is fastened to the base plate, in such a way that they will bear against the brass segment on each side of the shaft. Cut and mount these brushes or fingers as shown. If you have done the work properly, both the brushes and the brass segment will be insulated completely from any other metallic part of the switch frame.

The electric motor used to operate this switch was taken from an old electric locomotive, but any small motor can be used. It is desirable, of course, to use a motor that can be operated from the same source of current as that supplying the track layout.

No special work was done on the motor except to remove one pair of wheels entirely and to substitute a longer axle for that which held the other pair. One of the regular wheels was placed on the new axle, and a bushing was slipped over the other end of the shaft and the worm fastened on.

The motor is mounted on wooden blocks so that the worm will mesh properly with the worm gear.

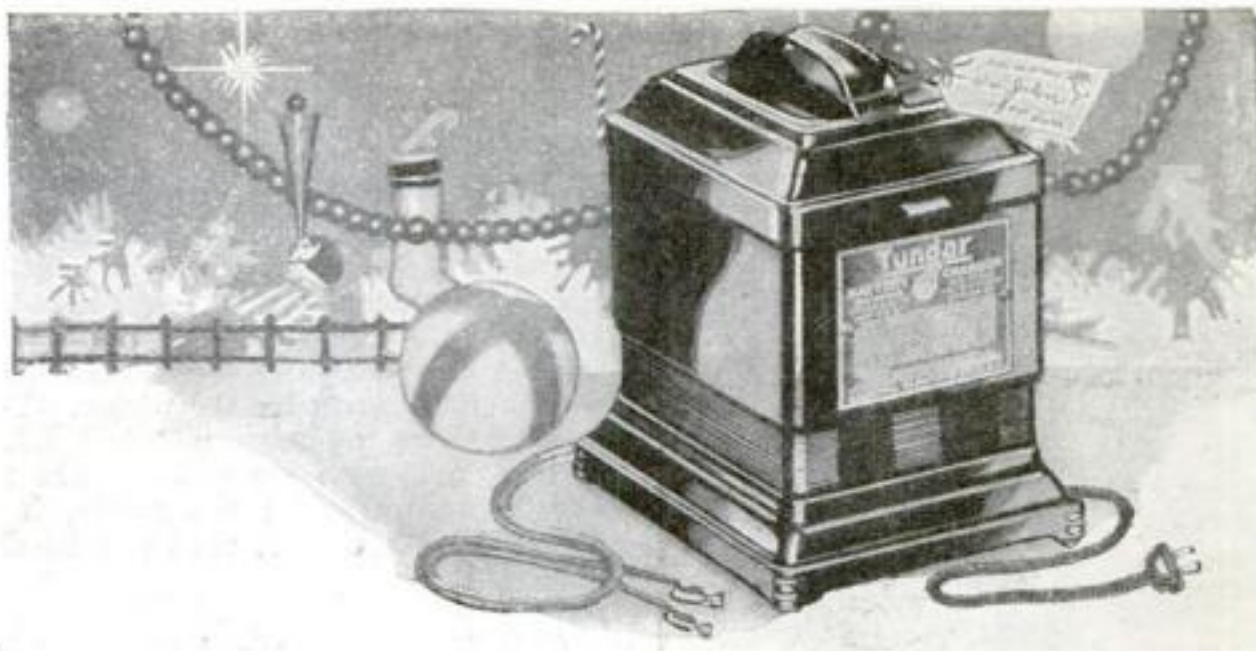
**T**HE remaining construction work consists in coupling up the worm gear by means of a connecting rod to the movable section of the switch.

Drill a 1/8-in. hole in the top of the worm gear so that the edge of the hole will be about 1/32 in. from the center hole. Drive a pin in this hole so that it will be a tight fit. Now bend up a piece of strip brass about 3/8 by 1/16 in. so that a 1/8-in. hole drilled in one end will fit over the pin in the top of the worm gear. The other end of the brass strip should be bent to form a U shape through which you can drill 1/8-in. holes for the connecting rod.

You will discover at this point that the total back-and-forth movement of the pin as the worm gear rotates is more than enough to throw the switch. This excess motion could be taken up by fitting the stud in the worm gear nearer to the center, but as this would necessitate the making of a special plate to carry the stud over the end of the shaft on which the worm gear rotates, you will find it simpler to fit a spiral spring to take up the excess motion. The latter method is to be preferred anyway, since it eliminates the necessity for gaging very accurately the length of the connecting rod.

There are several ways of fitting this spring take-up. Perhaps the best is to use two sections of spring with a pin through the connecting rod arranged so

(Continued on page 116)



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## The Home Workshop

### Automatic Switch Control

(Continued from page 115)

that one spring is compressed when the switch is thrown one way and the other spring is in action when the switch is the other way.

This completes the mechanical work and you are ready for the wiring. You will need an ordinary door-bell push-button to operate the switch. The reversing controller on the motor, if it happens to have one, need not be disturbed.

**S**IMPLY take the wire from the motor that ordinarily would go to the brush that makes contact with the third rail and connect it with the nearer of the two insulated brushes. Also run a wire from this brush to one binding post of the pushbutton. Connect the other brush with the third rail of the track at the nearest point and with the remaining binding post of the pushbutton. Obviously, the two wires going to the pushbutton can be made any length desired so that the switch can be operated from any place in the room.

The other supply wire for the motor is grounded to the framework of the switch, which is, of course, connected with the grounded rails of the track when the switch is placed in service.

What happens when you press the button? The current flows from the third rail to the motor by way of the button. The motor starts and immediately the worm gear begins to revolve and the brush that has been resting on the insulating material slides on the brass segment. The current then can flow from one brush to the other through the brass segment and the motor continues running even if the operator takes his thumb off the button. It keeps going until the switch is in the other position. At that point the other brush runs off the brass segment, the circuit is broken, and the motor stops automatically.

**A**T THE next pressure on the button the operation is repeated, leaving the switch in the reverse position. The motor will coast a bit after the current is turned off and if everything is well lubricated the friction may be so light that the over-running of the motor will carry it to the next brush contact and a pressure on the button may result in starting the motor into continuous operation.

The remedy, of course, is to make the gap in the brass segment wider or to arrange a friction drag that will stop the mechanism quickly after the current is cut off. You will have to adjust this to suit the motor and track voltage used in your own particular outfit.

Once set properly, the whole arrangement is simple, positive, and useful, and I see no reason why it should not stay on the job for years without giving the slightest trouble.

The second article on the auxiliary equipment for small model railways will appear in the January issue.

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6-volt, 100 Amperes	\$11.25
6-volt, 120 Amperes	13.25
6-volt, 140 Amperes	14.00

**Solid Rubber Case Auto Batteries**

6-volt, 11-Plate	\$11.25
6-volt, 13-Plate	13.25
12-volt, 7-Plate	16.00

**SEND NO MONEY**

Just state battery wanted and we will ship day order is received, by Express, C. O. D., subject to your examination on arrival. Extra Offer: 5 per cent discount for cash in full with order.

**WORLD BATTERY COMPANY**  
Dept. 7  
1219 So. Wabash Ave., Chicago, Ill.

# World

## BLANK CARTRIDGE PISTOL

Protection against Burglars, Tramps, & Dogs

**PRICES**  
**50c.**  
**\$1.00**

**POST-PAID**

Well made and effective; modeled on latest type of Revolver; appearance alone is enough to scare burglar. When loaded it may be as effective as a real revolver without danger to life. It takes standard .22 Cal. Blank Cartridges obtainable everywhere. Price 50c. Superior quality \$1.00 Postpaid. Blank Cartridges, by express, 50c per 100.

Johnson Smith & Co., Dept. 456 Racine, Wis.

Now, Only **\$39**

**Let Me Send You the Greatest LOG SAW Offer**

—I ever made. One man saws 15 cords a day—easy. Falls trees, saws limbs. Make big money. Use 4 H.P. Engine for other work. Saws faster than 10 men. Shipped from Factory or nearest of 10 Branch Houses. Cash—Easy Terms. Write for 30-Day Trial Offer and big FREE book.

**OTTAWA MANUFACTURING COMPANY**  
1301-W Wood Street, Ottawa, Kan.  
Room 1891-W Magee Bldg., Pittsburgh, Pa.

## ZIP-ZIP

THOUSANDS of boys are made happy with this wonderful Zip-Zip shooter, something every boy wants and never gets tired of. Zip-Zip shooter is scientifically and practically made; boys, if you like hunting and outdoor sports, get a Zip-Zip shooter with plenty of pep and force and learn that quick and sure aim. If your dealer happens not to have them, order from us. Zip-Zip shooter complete 35c or 3 for \$1.00; send stamps, coin or money order.

AUTOMATIC RUBBER CO., Dept. 22, COLUMBIA, S. C.

## Getting Ahead?

Read the advertisements on  
Pages 138 to 166 this issue  
if you want to get ahead!

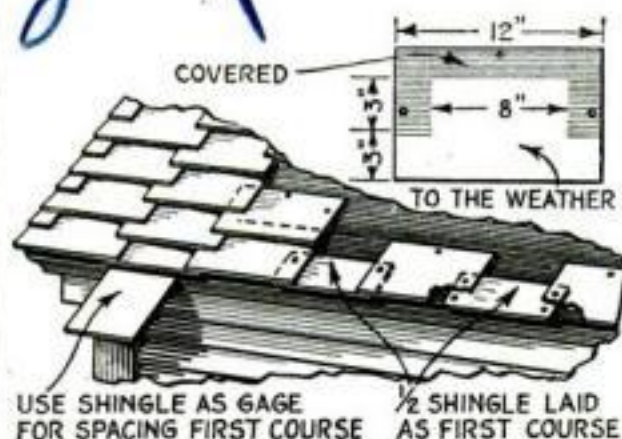


## The Home Workshop

### How to Lay Asbestos Shingles to Cover a Greater Area

ILLUSTRATED below is a way of laying slate-surfaced asbestos shingles at a saving of nearly one-half the shingles and one-fourth the nails in comparison with the usual method. It is intended particularly for use when the shingles are to be laid on a steep roof or the side of a building and on gables and dormers. It has an attractive appearance and adds variety where needed.

In cheap construction, roll roofing, plain and printed, with a slate surface, is often used over sheathing as a temporary or permanent substitute for siding. In-



When laying shingles in this way, a guide line should be drawn for each row

dividual 8 by 12 in. shingles cost about twice as much as plain roll roofing, and are designed to lay 4 in. to the weather, but by laying them as shown, a square of 8 by 12 in. shingles will cover nearly two squares of surface. In this way the cheap appearance and sagging, often seen where roll roofing is applied to a vertical surface, can be avoided at little higher cost.

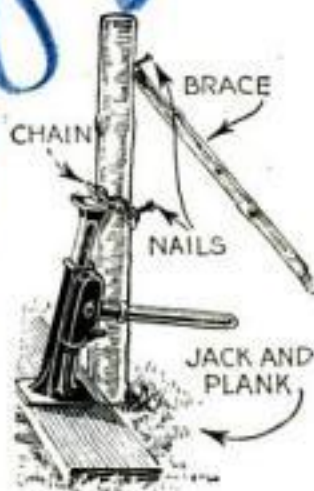
To put it another way, 60 sq. in. of surface is covered by each shingle, against 32 sq. in. where the usual construction is followed.

Particular attention should be paid to the nailing. Three nails are needed for each shingle, placed about 1 in. from the edge and at the middle point of the top and sides. Do not use nails with thick heads.—C. H. DUNBAR.

### Jack Raises Fence-Posts

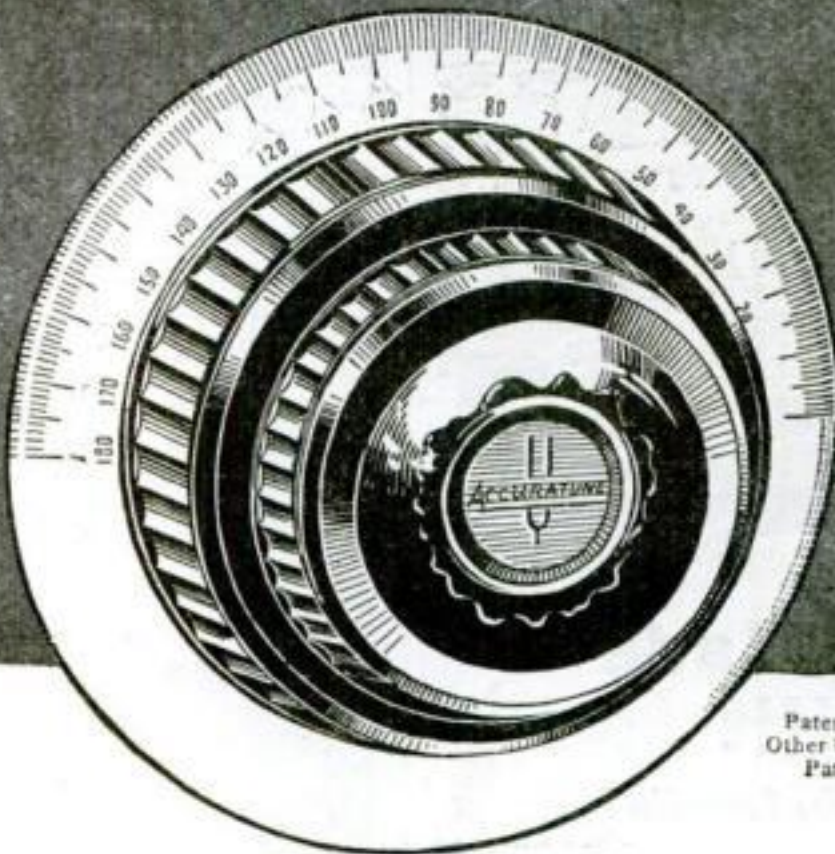
AS A variation of a method for taking up fence-posts, of which I read some time ago in POPULAR SCIENCE MONTHLY, I raised a number of posts from frozen ground by the use of a jack as illustrated. A short piece of strong chain was placed around the post and held with a nail. The post was braced at the top with a long piece of wood and then the jack, resting on a plank on the ground, was applied to the chain so as to lift the post. When the jack reached its limit, the chain was dropped down and a new grip taken.

—E. B. ROBERTS.



Lifting a post

# ACCURATUNE



Patent April 21, 1925  
Other U. S. and Foreign  
Patents Pending

## Refine Your Receiver~

Accuratune dials not only enhance immeasurably the attractive appearance of your set, but they insure clear and precise reception of programs, with all the high lights and shadings preserved with infinite accuracy, and with even those stations now so closely grouped on the lower wave lengths easily and readily segregated—thus truly refining reception.



MYDAR RADIO COMPANY  
15 CAMPBELL STREET - NEWARK, N. J.

## 9 Made \$368 BONUS LAST MONTH



"In just one month my bonus on old sales, which had already paid me my regular profit, totaled \$368.50," writes K. D. Ralph. We have originated a startling new sales plan which brings you profits while you sleep. Nothing like it ever heard of before.

### AMAZING EXTRA PROFITS

Often you can make one simple, little sale that will go on working for you, paying you sensational extra profits without extra work on your part. Our men report sales of from 19 to 83 in one day. One boy sold nine in three hours. We can't explain our plan here—others might copy it. But just write and we will send full details confidentially. No experience needed. Ideal for spare time work.

RHODES MANUFACTURING CO.  
Dept. W-240 Pendleton & Cozens Ave. St. Louis, Mo.

### The Hawkeye Reminder Clock

It cost money to forget! Whether it is in the Kitchen, Office, Studio, School Room or Factory.

We can supply you with the reliable, well made and guaranteed Hawkeye Reminder clock that is "watchful of the time." Easily set to one, three or ninety minutes and rings Exactly on the minute when time is up. Prevents Forgetting, and thereby saves Time, mind and money. Handy size, gray enamel finish, hangs flat against wall or sets on table. New Lower Price—\$7.50.



Makes an Ideal and Practical Christmas Gift  
HAWKEYE CLOCK COMPANY  
Muscatine, Iowa. Distributors Wanted





## Sure Made a Hit

**Look at that smile!**

A doctor friend of ours remarked the other day that he got a bigger kick out of a set of Snap-On Wrenches we gave him for his car last Christmas than from any other gift he received.

He hadn't forgot our gift. The eight dollar shirts and all such gifts were gone, but here was something different—a set of genuine Snap-On Wrenches like nine-tenths of the garages are now using—which made easy work of jobs on his car he had never tackled before.

We thought this was worth telling at this time because you will soon be up against that same old yearly question—"What the devil can I give dad, or sonny, or brother Bill?"

Any Snap-On Dealer can show you the selected Snap-On Set for any make of car or a complete set for the mechanic who works on all cars. He will make up a useful set of genuine Snap-Ons to suit any purse. And it will be a two-fisted, he-man sort of gift that will make a real hit. Mail Coupon for name of nearest dealer.

**SNAP-ON WRENCH COMPANY**  
Manufacturers, Milwaukee

**Snap-on**  
INTERCHANGEABLE  
Socket Wrenches

Look for the name Snap-On on each handle and socket. It is not a genuine Snap-On without the name.

®

**Motor Tool Specialty Co.,**  
14 E. Jackson Blvd., CHICAGO

Gentlemen:  
Please send particulars about Snap-On Set for.....car  
For Master Mechanic's Set for all cars, check here.....  
Name.....  
Address.....

## The Home Workshop

### Finishing the Dormer

(Continued from page 78)

can be used to support the short sheathing boards of the dormer overhang.

A CONTINUOUS strip of tin or galvanized iron 16 in. wide is laid in each valley and curved into it, avoiding sharp bends. Some builders prefer valley flashing with an inverted V bent in the center, which has the advantage of preventing water from rushing up the opposite slope after acquiring momentum on another. Strike two chalk lines about 2½ in. apart at the top and 3 in. at the bottom to guide the shingles.

The courses are laid in a straight line (unless the fancy or "jazz" style is used) with each shingle lapping sidewise over the one below at least 1 in.

A joint between two shingles in one course should not come directly over one in the second course below, since a split under the joint in the shingle next below



A typical dormer that shows clearly the boxed-in overhang and method of shingling

would make three joints in a line and a leak would result.

There are three methods of keeping the courses straight. The professional shingler uses a gage on his hatchet blade, which catches the butts of the course below. The loose shingle is rested against the head of the hatchet when laid flat. By this means he is able to "carry" several courses at once, speeding up the work.

THE home mechanic may use this method if he is careful, or he may strike chalk lines as guides. A straight-edge tacked to the last finished course is probably best for the average man. Make a "jack" to sit on, as described last month, or use a toe cleat as illustrated in the drawings on page 78. The latter is made by nailing two or three shingles to a convenient length of "two by four" and tacking the butts of these shingles to the roof. To move the cleat, twist upward from the bottom.

Valley shingles are cut to fit the valley angle. Tack together a dozen shingles of medium width and saw the bundle to the required angle. Lay these with the grain parallel to the valley. This not

(Continued on page 119)



## "That Musical Pal of Mine"

If you want to make this Christmas a Merry Christmas, ask old Santa to bring along a Hohner Harmonica—and "tune in" on happiness.

No other gift, regardless of price, offers greater possibilities for clean, wholesome fun, entertainment and musical training. With the aid of the New Instruction Book, containing charts, pictures and favorite musical selections, anyone can quickly learn to play a Hohner Harmonica.

Order a Hohner for every member of the family this Christmas and make the "joyful season" last the whole year 'round. If your dealer cannot supply you with the Free Instruction Book write M. Hohner, Inc., Dept. 182, 114 East 16th Street, New York.



## MOTORCYCLES

**LESS THAN HALF COST**



Ace, Indian, Cleveland, Harley-Davidson, Henderson Motorcycles and Sidecars, new, used and rebuilt. Rider Agents Wanted. Write for FREE trial offer, agent's free outfit and big bargain bulletin. New American Bicycles in different styles and colors. Write for illustrated catalog giving our money saving prices.

AMERICAN MOTOR CYCLE CO.  
2047 W. Chicago Ave., Dept. 1234 Chicago

## "LIGHTING FIXTURES"

Ready to hang.  
Direct from the manufacturer.  
Completely wired including glassware.  
Send for New Catalogue No. 27 (Just reduced prices)  
Special proposition to Dealers  
**ERIE FIXTURE SUPPLY CO.**  
Desk A, Erie, Pa.



## Mr. Brush Salesman

Unusual opportunity is offered for aggressive, ambitious, hustling men to represent an old established manufacturer of high-grade, guaranteed, fastest selling line of Sanitary Twisted-in Wire Brushes, sold direct to the Home. We have openings for experienced brush men as managers in all territories. We want live wire, energetic Go-Getters. We pay larger commissions than any other Brush House in the Country. If you want to earn some real money, it will pay you to write us immediately for our proposition.

**WIRE GRIP SANITARY BRUSH CORP.**  
15 MERCER STREET NEW YORK CITY

## Getting Ahead?

Read the advertisements on Pages 138 to 166 this issue if you want to get ahead!



## The Home Workshop

### Finishing the Dormer

(Continued from page 118)

only presents a strong edge, but exposes less end grain to the flow of water down the valley. The triangular butt shingles resulting from the cut may be used as hip shingles where needed.

The method of "rip-rapping" along the ridge is shown in the lower right-hand corner of the drawing on page 78. Strike a chalk line on each side of the ridge 4 in. down, and shingle from the gable to the valley with 5 in. to the weather, lapping the right-hand shingle over the left for the first, and alternating with every successive shingle. Nail the butts well.

THE casement frame and sash can be obtained from a sash and door mill or made, as you prefer. Mills are apt to charge heavily for any special work, so that, while it hardly pays to make standard sizes of window-frames and sash, it is often more economical to make special sizes by hand.

The construction of the casement frame is shown in detail. The side and head jambs are of 1-in. stock well smoothed and jointed straight to a width of  $4\frac{3}{8}$  in. This allows  $\frac{3}{4}$  in. for sheathing,  $3\frac{3}{4}$  in. for studding, and  $\frac{3}{8}$  in. for plaster board. Allow a lesser amount for thinner wall-board.

Cut a piece 4 ft. 8 in. long for the head and lay out for  $\frac{3}{4}$ -in. dados  $\frac{3}{8}$  in. deep, as detailed. Use this as a pattern for laying out the sill, making the window-width lengths  $\frac{3}{8}$  in. long on each end to fit into corresponding dados in the side jambs. Use 2 by 8 in. white pine or redwood for this, giving it the same pitch as other sills in the house.

Cut the side jambs 2 ft. 3 in. long. Square one end of each and lay off in pairs, with a distance of 2 ft.  $\frac{1}{8}$  in. from the upper end to the sloping dado for the sill, measuring along a line  $1\frac{3}{8}$  in. from the inside edge. This allows for  $\frac{3}{8}$  in. "gaining" into the head, and  $\frac{5}{8}$  in. for the thickness of the stool, so that the casement will be a full 2 ft. in the clear in height.

NAIL a blindstop of 1 by 2 in. stock on the outer edge of each, using a  $\frac{1}{2}$ -in. block against the jamb face to gage the projection. Notch to fit over the sill and assemble the jambs with the sill, if necessary wedging from the under side of the sill to insure tight joints above. Nail on the head jamb, cut off the side blind stops  $\frac{1}{2}$  in. below the jamb face, and nail on the head stop. Gage pencil lines on the stops  $\frac{1}{2}$  in. from the inside edges.

Joint up a 1 by 5 in. piece for the head casing and nail on, guiding by the gaged line. Cut the beveled ends of the side casings and mullion, lay a scrap of casing next the sill on each blindstop, lay the side and mullion casings in position upside down, and mark the position of the top cut by squaring up from the head casing. In this way the exact length is obtained. Cut a trifle long, so that, in

(Continued on page 120)



**THE KODEL MICROPHONE LOUD SPEAKER** is an exact replica of the transmitting microphone used in broadcasting.

The efficient Kodel reproducing unit, with an ingenious new snail-shell horn, mounted inside the microphone case, produces a remarkably clear, full-toned volume. Non-vibrating tone chamber eliminates distortion.

The \$15 model incorporates the new Kodel, Jr. unit; with the large Kodel unit, \$20

Radio dealers everywhere have them

THE KODEL RADIO CORP  
500 E. Pearl St., Cincinnati, O.

**\$15.00**

**The KODEL MICROPHONE LOUD SPEAKER**

Design Patented

**NEW VEST POCKET ADDING MACHINE**

**ADDS • SUBTRACTS MULTIPLIES • DIVIDES**

Does all the work of a \$300.00 machine, yet fits the vest pocket. Easy to operate—does any kind of figuring in a jiffy. The neatest and best constructed portable adding machine made.

**Counts Clear Up to 999,999,999**

Total visible at all times. A pull of the finger clears it. Invaluable to anyone who uses figures. Saves many times its cost by preventing mistakes.

**10 Days' Trial** Send no money. Just name and address and we will send machine postpaid. Pay postman on delivery \$2.95. Use it 10 days to prove it does all we claim. Your money back if not perfectly satisfied. Don't be fooled by cheap imitations. Order your Ve-Po-Ad now from this ad.

**Reliable Adding Machine Corp., Dept. 159**  
184 W. Washington St., Chicago, Ill.

**AGENTS** Here's a money maker. Everybody wants one. Splendid profit. Write for special offer.

**\$2.95**

**Get this FREE Record!**

DOUBLE-DISC phonograph record of two beautiful Musical Saw solos sent without charge. Hear the marvelous possibilities of this sensational instrument.

**Complete Outfit Sent On Trial**

**PLAY A SAW**

No notes to read. No dreary practice. Just three short, simple lessons and you play popular and classical music. I guarantee success; no charge whatsoever if I fail. Thousands of my students are amazing friends, playing in dance and broadcasting orchestras or at lodge and church entertainments. Write for SPECIAL INTRODUCTORY OFFER of Saw, Hammer, Bow and Resin, FREE with Course of Instruction and how you can obtain complete outfit on trial.

**MUSSEHL & WESTPHAL**  
261 West Water St. Fort Atkinson, Wis.



## NEW MAGNETIC Veeder Counter

*Wires in Reports from Machines*

From machines in the shop to the dial over your desk, production-records come in—via this *Veeder* Magnetic Counter.

Installed in your office, it indicates work being done by the man and machine in the factory, or apparatus in the laboratory.

This is the latest and greatest advance in giving you a convenient count. Immediate records—close supervision—from any distance that wires connect with the

# Veeder

This "Form U" small Magnetic Counter counts machine operations or units of output, electrically communicated.



Cut 1/2 Size

Mechanical contacts on your machine make and break the electrical circuit which operates the counter. The electro-magnetic drive can get its current from your regular lighting circuit: Direct current, 110 Volts.

For machines, devices or apparatus where you can't put on a mechanically operated counter, you readily attach a contact-maker and get your count "over the wires."

"Form U" and larger Magnetic Counters are fully described in a special bulletin. Write for copy—along with the full-line Counter Catalogue.

**The Veeder Mfg. Co.**  
44 Sargeant St., Hartford, Conn.

## The Home Workshop

### Jack Frost Decorates an Outdoor Christmas Tree



JACK FROST, at least in the colder States, always is ready to do the major part in decorating an outdoor Christmas tree. It is possible, indeed, to have a brilliant tree in your own back yard or in a public park without any other expense for ornaments than the cost of lights, if illumination is desired.

The sparkling effect, which is illustrated above, is obtained by playing water on the tree from a garden or fire hose some night when the temperature is low enough to clothe the boughs with icicles and fantastic crystal garlands. A tree prepared in this way is a glittering spectacle in the sunlight and is even more striking at night under the light of colored electric lamps.

The wiring and lamp sockets, it should be noted, must be of a type to resist dampness and outdoor exposure.

It is not even necessary to use a real Christmas tree. The one shown is a pole with cross-arms to which old shrubbery has been bound to form the shape of a fir tree.—K. H. HUNTING.

### Finishing the Dormer

(Continued from page 119)

nailing down, the casings will wedge tightly at the joints, top and bottom.

In setting the frame, cut off the projecting jambs where necessary and nail up with the head jamb level and side jamb plumb. Drive eightpenny common nails through the casings into the trimmers, leaving the heads flush.

Wedge the jambs and sill, and side up the front of the dormer, making tight fits at the corners and jambs. If the roof overhang is narrow, nail a flashing along the upper edge of the head casing. Shellac any knots or sappy places and prime all outside woodwork with paint before beginning the inside finishing.

In the fifth article of this series, next month, Mr. Love will take up the finishing of the interior of an attic room.

## Big 3 ft. Telescope

Has unusually powerful lenses—magnifying over 8 times. Makes people and objects miles away seem close. Brings new pleasures to home, farm, camp, travel, sport. See moon and stars as never before. New Ferry "Wonder" telescope has 5 sections—opens out over 3 ft. long, measures 12 inches closed. Big, strong and powerful yet light, compact, easy to carry. Body and draws fully brass bound with knurled edges. Body covered with black leatherette, draws made of special, smooth finish fibre, easy to slide in and out. Brass safety caps at each end to keep out dust. Powerful lenses are special clear achromatic European optical glass.

## Given

WITH EVERY TELESCOPE Handsome leatherette covered Carrying Case light, strong, complete with strap. Case is 12 in. long, 2 1/2 in. in diameter. Protects from dust and damage. Handy for farmers, auto tourists and bikers.

Read These Letters Thousands of Delighted Users

"I am delighted with the 'Wonder' telescope. Today I have been watching submarines 3 miles off the coast."—Philip Brush. "I can see across the Mississippi 3 miles and see people fishing."—M. L. Thorn. "I am nearly 80 years old and if I could not get another would not take \$10.00 for it."—A. R. Walker. "I can tell time on the church clock 5 miles away."—Edward Foster. "Could tell color of aeroplane 4 miles away."—Mrs. L. M. Yarbrough. "I saw a Light House 18 miles away."—Clyde Scribner. "Can see men working 7 miles away."—S. M. Gearhart. "I could see windmill more than 4 miles away."—Raymond Cosanova.

## Send No Money

Sign and mail coupon below and Ferry Wonder 3 ft. Telescope given with Carrying Case will come by return mail. Pay postman special bargain price of \$1.85 plus few cents postage. Satisfaction guaranteed or your money back. Send coupon today!

FERRY & CO., Chicago, Ill.

Ferry & Co., Dept. 9789  
3224 N. Halsted St.,  
Chicago, Ill.

Send me 3 ft. Ferry Wonder Telescope given with Carrying Case. I will pay postman \$1.85 plus postage on arrival. If I am not satisfied you will refund my money.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_

Catalog of Things You Want Sent Free

### For You—Mr. Sign Painter



It's the very newest and latest help for Sign Painters and Showcard Writers, Letter Patterns. Helps the inexperienced and aids the finished expert. Turn out neat signs in less than one-half the usual time. Make Sign Painting and Showcard

Writing as easy as A. B. C. Samples for stamp.  
JOHN F. RAHN, D-2433, GREENVIEW AVENUE, CHICAGO, ILL.

**BARGAINS!**  
SAVE 1/3 TO 1/2  
WRITE FOR CATALOG  
RANDOLPH RADIO CORP.  
159 N. UNION AV. Dept. 3 CHICAGO, ILL.

## See

the big Prize Offer on page 4 of this issue.



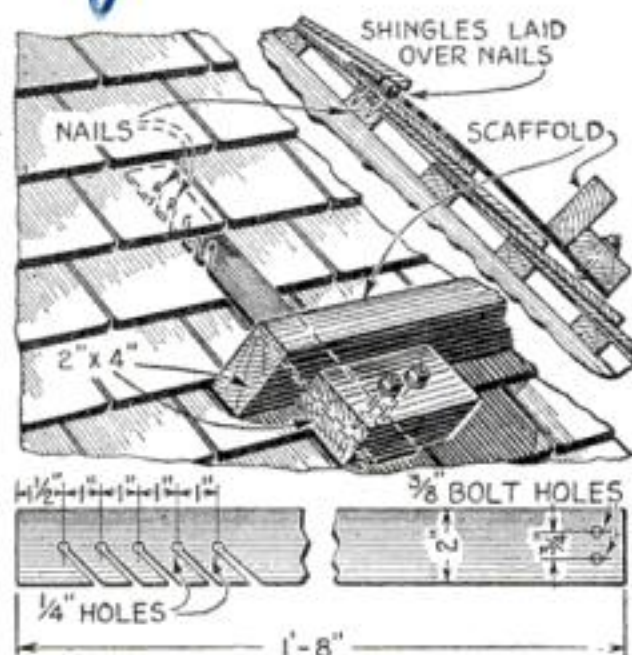
# The Shipshape Home

## Simple Roof Scaffolding

QUITE often the home-owner would like to undertake his own roof repairing, but is deterred by lack of knowledge and equipment. With a few simple tools and a bit of nerve, the most difficult roof can be scaled and repaired on it made satisfactorily.

The most necessary piece of equipment is a good ladder. One of the extension type, 30 ft. long when extended, is by far the best to buy. By all means get one that has hand-shaved rungs, as these are sure to be straight grained. See also that the grain of the side rails runs straight. Paint the ladder and it will last for years.

To form the scaffold on the roof, have from three to five pieces of 14-gage gal-



Details of a strong roof scaffold, which can be removed without leaving nail holes

vanized iron cut 2 in. wide and 20 in. long at the tin shop. Draw a line through the center of each and drill five  $\frac{1}{4}$ -in. holes 1 in. apart, starting  $1\frac{1}{2}$  in. from one end, as shown. Cut slanting notches from one edge to the holes.

One inch from the other end of the strip drill two holes  $\frac{3}{4}$  in. apart, large enough for a  $\frac{3}{8}$ -in. bolt to pass through them snugly. Take short pieces of straight-grained "two by four" and drill two holes through each to coincide with the holes in the iron strips. Bolt the blocks on as shown.

To use these brackets, fasten them at the desired distance apart by driving two or more nails at the upper or drilled part of the notches. The 2 by 4 in. blocks hold a long "two by four" that serves as a working platform. The whole makes a substantial scaffold.

After the job is completed, raise the lower end of each strip and shift the iron upward so that it will slip out of place, leaving no openings for the rain to beat in. It then will be possible to drive the partly projecting nails down hard.

—C. W. HUBERTZ.

(Continued on page 122)

**Daven**

IVAN T. NEDLAND  
HILLBORO, N. DAK.

April 11, 1925

Daven Radio Corp.  
Newark, N. J.

Gentlemen:

I installed one of your Super Amplifiers and must say that this was the biggest improvement I have ever put in a radio, and there is no question in my mind but that this is the only real way of amplifying as the tone is so far superior that there is no comparison between resistor and the different transformer that I have tried, and I have tried several low ratio of the best makes as well as push-pull.

Awaiting your manual with interest, I am,

Yours Truly,

I. T. Nedland

## "The Biggest Improvement I Ever Put In A Radio"

THE Daven Super-Amplifier is the last word in resistance coupled amplification. And resistance coupling is the only answer to the demand for QUALITY that has now become world-wide and insistent. Amplify the Daven way. Absolutely without distortion. The Daven Super-Amplifier is a revelation to music lovers. Sold by dealers everywhere, complete, for \$15.00. Knock-down Amplifier Kit—\$9.00.

For more volume without distortion we recommend the new Daven High MU Tubes. Know all about Resistance Coupled Amplification. Read the authority, the *Resistor Manual*. At best Radio Dealers, 25c. By mail 30c.

DAVEN PRODUCTS ARE SOLD ONLY BY GOOD DEALERS

*"The Sine of Merit"*

**DAVEN RADIO CORPORATION**  
Resistor Specialists

NEWARK NEW JERSEY

Reg. U. S. Pat. Off.

**Resistor Manual**  
The Handbook of Resistance Coupled Amplification at best radio dealers 25c. Direct by mail, postpaid 30c.

**CLIP THIS COUPON** Q-12-25

DAVEN RADIO CORPORATION  
158-160 Summit Street, Newark, New Jersey

Please send me the following on Resistance Coupled Amplification:—

Check One ☐ Resistor Manual. 30c. is enclosed.  
☐ Complete Catalogue (free).

Name.....

Address.....

For Dealers: Send your letterhead or card, or this coupon and we will have our nearest distributor communicate with you.

## THE BIG LITTLE THINGS OF RADIO

### BIG NOVELTY BARGAIN! 10 Cts.

**THROW YOUR VOICE**

Into a trunk, under the bed or anywhere. Lots of Fun fooling the Teacher, Policeman or Friends. Barrels of Fun.

**THE VENTRILO,**

a little instrument, fits in the mouth out of sight, used with above for Bird Calls, etc. Sent with full instructions; anyone can use it, NEVER FAILS. Also a 82 PAGE BOOK ON VENTRILOQUISM. Formulas for Secret Writing, 12 Money Making Secrets and the marvelous

**NOVELTY X-RAY WONDER**

With it you can apparently see the bones in your fingers, lead in pencil, etc; lots of fun with this outfit. Also 10 Big Magic Tricks Free with every order. All the above Novelties by prepaid mail for 10¢

**VENTRILO COMPANY**  
Dept. 304 Norwalk, Conn.  
LARGEST and OLDEST Mail Order House in Connecticut.

**WANTED**

Men to manufacture Metal Toys and Novelties. Good chance to start your own well-paying business producing such big sellers as Toys, Novelties, Ash Trays, Book-blocks, Souvenirs, Advertising Specialties, Paper Weights, etc. We furnish forms with complete outfit for speedy production. Absolutely no experience of tools necessary; no special place needed. Small investment put you on road to success. Demand exceeds supply and we assist and co-operate with our manufacturers in selling their products. We put you in touch with the buyers and assure an outlet for your goods. Strictly a business proposition and thorough investigation invited. A splendid opportunity for an enormous and profitable business for ambitious men. No others need apply. Catalog and information mailed on request.

**METAL CAST PRODUCTS CO.**  
1696 Boston Road New York



# Klein Pliers Tackle Any Job!

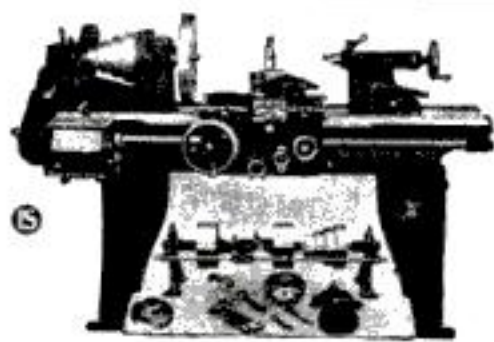
FOR radio and auto Klein Pliers are indispensable, of course. But that's not all! Klein's are plucky pliers that tackle *any* job with a keen bite and a stubborn grip. Handy fellows in every tool box! Pick up a pair at your hardware store.



Mathias **KLEIN** & Sons  
Established 1857 Chicago, Ill. USA

## \$100 in Cash Prizes

See Page 4 in front of book for details



## THIS LATHE in your shop

SOON EARNS ITS OWN COST ON OUR  
**Easy Payment Plan**

We will ship you any size South Bend Lathe on terms of a small payment down and balance in convenient monthly payments. In this way the Lathe saves and earns its own cost.

### Note Our Low Prices

On South Bend Screw Cutting Standard Change Gear Lathes

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13" x 5' " ... 304	18" x 10' " ... 656

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## The Shipshape Home

(Continued from page 121)

### Repairing an Old Sash

OLD window-sash, especially if they have not been kept well painted, are apt to come apart at the joints, so that they can be raised or lowered only with great difficulty. They can be repaired by applying angle plates cut from rather heavy galvanized sheet iron. Holes are drilled or punched in the plates to take brass or galvanized-iron wood screws. It is sufficient usually to place the braces outside, but if desired, narrow ones also can be used inside and painted.



Metal reinforcement

### Repairing Broken Plaster

WHEN the plaster on walls or ceilings has become cracked, it often may be repaired effectively with thin metal washers of the type generally used in laying tar-paper roofs. The central hole of each washer should be enlarged, if necessary, to fit the shank of a 1-in. No. 6 round or flat-head steel wood screw. Washers are fastened at 2-in. intervals along each crack. When whitewashed or painted over, these fasteners are not very noticeable from a distance.—IVAN H. CROWELL.



### Freshening Up Plaster Walls

WHITE plastered walls that have never been decorated become dingy looking in the course of time, especially in kitchens. When it is desired to avoid the cost of painting or papering, I have found a wall can be rejuvenated very cheaply with a mixture of lime, plaster, and water. When properly applied, this leaves the walls a creamy white, which will not rub off like whitewash.

Any cracks and other defects are first repaired with ordinary commercial patching plaster. Then the lime and unfibred gypsum plaster are mixed in the proportion of one part lime to four parts plaster. Mix well and add about 2 qts. of the mixture to 3 gals. of water. Strain and apply with a whitewash or paint brush.

If the walls are sprinkled with water before applying the mixture, the finished surface will be more even in appearance. Don't mix more than can be used in a half-hour, as the lime and plaster set rapidly. Keep the wash well stirred while in use.—RUFUS E. DEERING.

(Continued on page 123)



## The Shipshape Home

(Continued from page 122)

### Painting Wire Fences

FACED with the tedious job of painting 250 ft. of wire fences, one home-owner found he had covered only 10 ft. with an ordinary paint brush after an hour's strenuous efforts. Then an idea struck him.

"Why not scrub the paint on with a cocoanut-fiber scrubbing brush?" he asked himself.

The paint was placed in a pan large enough to allow the 1-ft. long scrubbing brush to be dipped in flat. Then the fence was literally scrubbed with paint. In four hours the work was done.

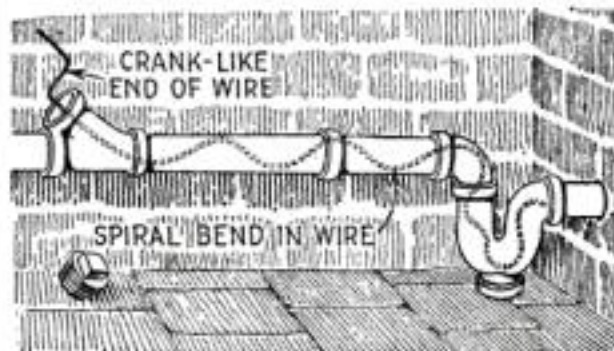


Scrubbing with paint

The waste of paint was less than if an ordinary brush had been used, because spraying occurs only at the edges and there is less "edge" to a big brush in proportion to its area. The method is equally useful for chicken-wire fences, which often are allowed to rust away because painting is too costly. Such fences can be scrubbed with tar paint at a very low figure.—C. E. D.

### Cleaning a House Sewer

STOPPAGE of house sewers often occurs between the trap and the street main. The common practice is to dig up the pipes, but a cheaper and usually effective scheme is to work a long wire through the trap as illustrated. A good quality of spring fence wire about  $\frac{1}{8}$  in. in diameter is needed. One end of it is formed into a one-turn coarse spiral about



Heavy wire is screwed through obstruction

2½ in. in diameter and 6 or 8 in. in pitch, with a small loop at the very end. The spiral should be right-hand or left-hand, according to the angle that the wire approaches the trap. The other end is bent into the form of a crank for rotating the wire.

The wire is inserted through an incision in the sewer pipe inside the house, or, better still, by introducing a Y between the trap and the house, with a branch extending to the cellar bottom or, if more convenient, to the surface of the ground outside.—E. W. CORNELL.

# The Amplion Pedigree

Thirty-eight years ago—

In 1887 Mr. Alfred Graham invented and demonstrated the first practical loud speaker which the world had ever heard (illustrated above).

In 1893



Graham Loud Speakers placed upon market. Illustration shows the "1893 model."

In 1894 Graham Loud Speakers first used in British Navy. Graham transmitters applied to phonographs for loud speaker reproduction.

In 1896 Graham Loud Speaking Naval Telephones developed and adopted by British Admiralty.

In 1898 Graham Watertight Loud Speakers patented. Placed on many warships and mercantile vessels, throughout world.

In 1902 Complete Graham Loud Speaker installations, on central battery plan, erected on warships as sole means of communication.

In 1906 The most extensive loud speaking naval installation to date was made by Grahams. Included a Graham exchange system fitted to H. M. S. Dreadnought.

Onwards Graham Loud Speakers applied to all sorts and conditions of service at home and abroad, ashore and afloat.

By 1919 No less than 12,000 Graham loud speaking installations in operation on ships alone.



In 1920 (before radio loud speakers were in common use) "AMPLION" Loud Speakers produced for radio by Alfred Graham & Co. "AMPLION" trademark registered.

In 1922 Amplions adopted as standard equipment by leading makers of radio sets abroad.



In 1923 Amplions introduced into United States, Canada and other countries. Quickly attained largest throughout-the-world sale of any loud speakers.

In 1924 To supply demand The Amplion Corporation of America was formed to market and manufacture Amplions here.

In 1925 More Amplion companies formed and agents appointed throughout world to keep pace with international demand. The Amplion Corporation of Canada, Limited, organized.

Created by the actual originators and world's oldest makers of loud speakers, it is only logical that the Amplion should be "the world's finest" radio reproducer. Some of the countries in which Amplions rule as favorites:

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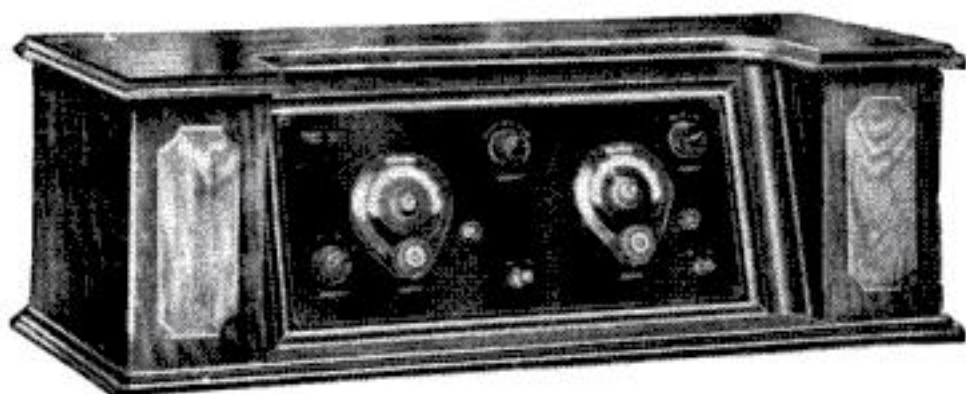
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## Better Shop Methods

(Continued from page 74)

## Three Ways to Repair Gears

By E. N. Davey

"BRING that auto flywheel over here—we have some dental work to do," "Dad" Bradley said to the shop's lone apprentice. In a few minutes the youngster had the wheel on the bench in a space Dad had cleared of its accumulation of rubbish. The gear had four teeth broken out.

"Will we put pins in this, like we did to the big wheel last week?" Claude, the apprentice, asked.

"Not this time," Dad replied. "We want a better job on this one."

The machinist proceeded to lay off some small holes as shown in Fig. 1, so that he could break out the base of the

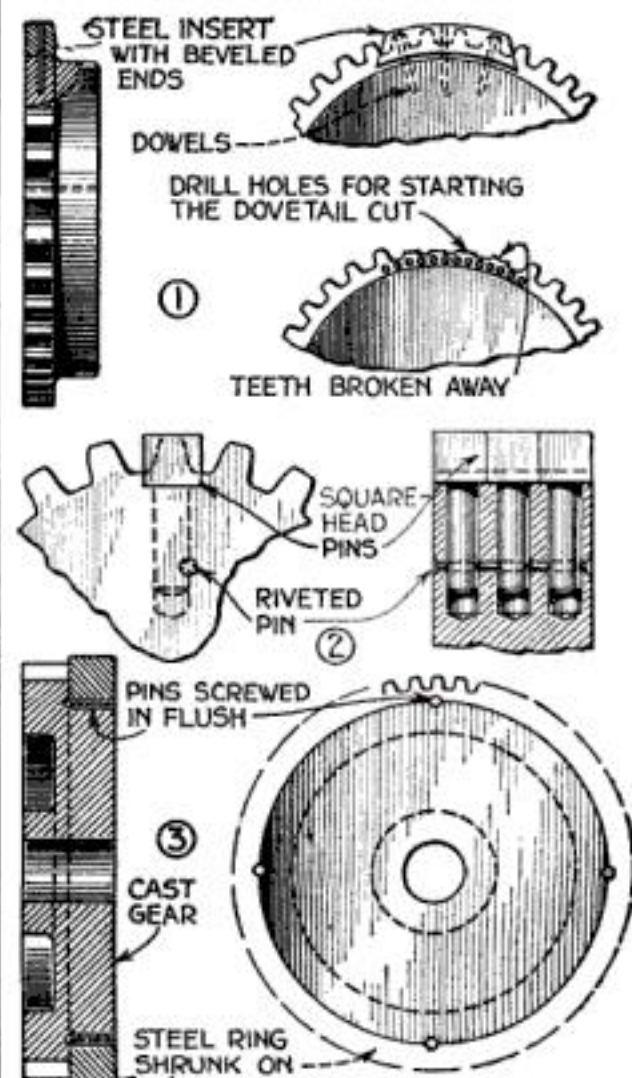


Fig. 1. A dovetail patch. Fig. 2. A workman-like single-tooth repair. Fig. 3. A shrunk-rim job

damaged teeth. Then he made dove-tails at the ends of the opening. A piece of cold-rolled steel was bent to conform to the radius of the seat, and the ends were dovetailed to correspond. Dad was careful to make the insert long enough to be tight. The prepared seat then was slightly heated by means of a blowtorch and the insert was slipped into place.

"Now, Claude," Dad said, "drill three holes for the dowels and drive them in, and you will be ready to cut the teeth. Be sure you file a little flat on the pins so the air can get out when you drive them in."

When Claude returned, he found another gear in the older man's vise. One tooth had been removed and a slot cut about an eighth of an inch deep at the bot-

(Continued on page 125)



## Better Shop Methods

### A Cheaply Made Packing-Hook



TO REMOVE old packing in stuffing boxes on steam engines, pumps, and other machinery, a packing-hook often is used. This is a simple tool with a wood screw at one end. A substitute can be made by straightening out a common wire clothes hook as shown. On extra large sizes of packing, it is well to use two hooks, one on each side, so that the rings will come out more easily.

### Three Ways to Repair Gears

(Continued from page 124)

tom, as in Fig. 2. Dad was carefully laying off three holes in the bottom of the slot.

"I want you to drill these holes with a quarter-inch drill," he said. "Be careful to drill them where they are laid off. I am going to make three tool-steel pins to drive in the holes, and I want to fit the center one so there will be no space between them, as there is in the ordinary pegged gear. We will put in a small pin so that it passes partly through each of the pins to make sure that they do not come out. This will make a repair that is strong enough to stand up under the heavy work that this gear has to do. The pegs can neither twist out of line nor work out."

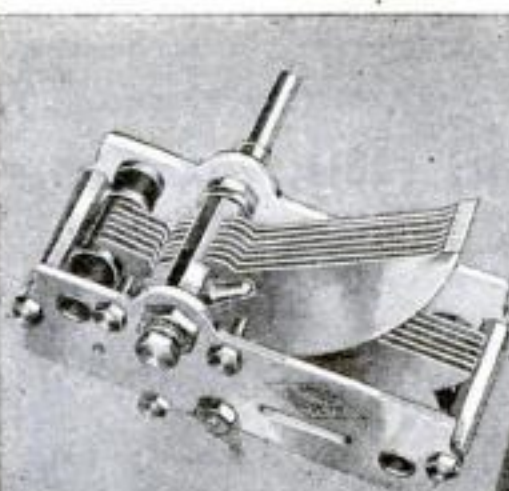
Gears seemed to be Dad's only job this morning, for he had still another one to repair. He studied it for some time before he did anything. It was a gear about 12 in. in diameter and had teeth broken out all around it. Only about half of each tooth was gone, while the other half was good.

After musing for several minutes, he decided he would put a steel ring on half the face of the gear, as shown in Fig. 3. He turned off the broken teeth and cut down about  $\frac{3}{4}$  in. below the bottom of the teeth. He had the blacksmith forge a steel ring, which he bored and faced on one side, chamfering the corner a little. He bored the ring .015 in. smaller than the gear for a shrinkage fit.

He heated the ring to a dull red and slipped it over the gear. He slowly sprinkled water on it until it was cool enough to handle. When tapped with a hammer, it gave that solid sound that indicated it was tight. As a precaution, though, he drilled and tapped four holes, half in the casting and half in the ring, for plugs that were cut off flush.

The gear was mounted on an arbor, turned and faced, and while still on the arbor, the teeth in the steel ring were cut to match those in the original gear. The gear thus repaired was good for a longer life than when new.

"HOW to Fit Machine Keys," an article scheduled for early publication in the Better Shop Methods Department, contains kinks of practical interest to every machinist.



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Plan your work ahead.

Taps often are broken by being used when dull.

If there is more than one way to do a job, take the easiest way.

Avoid the use of rosin on belts, as it does little good and ruins the leather.

The quality and quantity of work a tool will do depend upon the way it is ground.

Never place your hand near a revolving cutter to brush away chips; use a soft wooden stick or a brush, or else stop the machine.

There isn't much excuse for gripping a hammer handle at the middle instead of near the end, because if the hammer is too heavy for the work, a lighter one should be used.

Keep your eyes on the best mechanic in the shop; it is a good way to learn the proper use of tools.

To harden small tools or parts that are apt to warp, heat them carefully and insert them in a raw potato; then draw the temper as usual.

**Container for Quenching  
Small Parts Quickly**

**W**HEN small parts are to be hardened, they should be quenched the instant the correct heat has been obtained. With this end in view, one garage owner devised the special hardening tank illustrated.



Heating stand and small water tank

It is a round metal pan with two upright pieces of sheet metal brazed inside it. To these is brazed a plate with a hole in the center.

The tank is only half-filled with water, so that parts falling into it will not cause splashes. The parts to be hardened or case-hardened are laid on top of the plate around the hole.

After each part has been heated with an oxyacetylene torch, it is pushed through the hole and falls directly into the tank.—H. W. MOORE.



Old Bill, machine-shop foreman

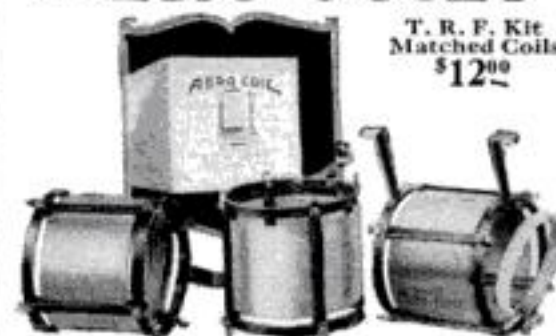
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## Better Shop Methods

### Eccentric Attachments for Lathe Chuck

**E**VEN that most useful of all machinist's tools, the four-jawed chuck, sometimes fails to meet all demands.

Figure 1 shows an odd-shaped casting with two holes that must be bored parallel. To chuck and true up this piece for each of these holes in succession would be a tedious job, but the angle plate attached to an especially made jaw makes it easy to move the piece over for boring the second hole, provided the original clamp-

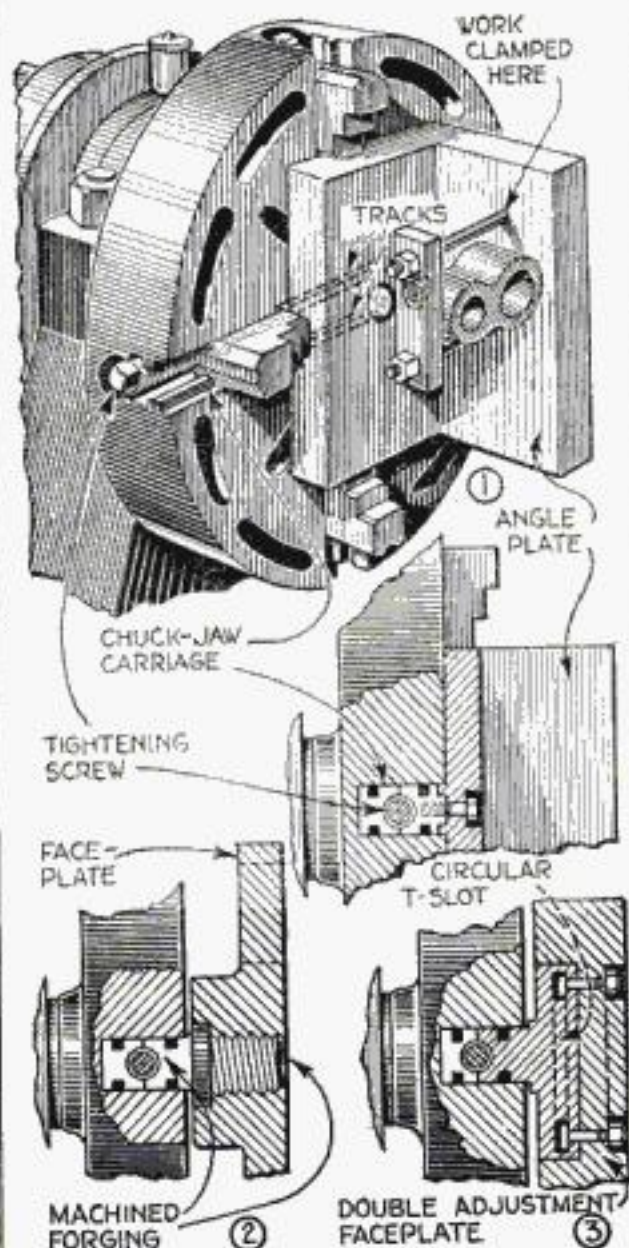


Fig. 1. Angle plate attached to special chuck jaw. Fig. 2. Eccentric attachment. Fig. 3. Adjustable faceplate useful for awkward work

ing was done with this in mind. The angle plate is bolted to the jaw or attached with countersunk-head screws.

The attachment shown in Fig. 2 is useful for machining eccentrics. It is a steel jaw with a threaded nose to fit a chuck or faceplate from another lathe.

Illustrated in Fig. 3 is an auxiliary faceplate mounted so that it can be revolved and clamped with T-head bolts in a circular slot. This can be used to advantage on some awkward work.

The other jaws of the chuck can be used to lock the special jaw with each of these devices.—ALLEN B. SHAW.

If a grinding wheel is out of balance, it is apt to cause chatter marks on the work. This often is overlooked when seeking the cause of the marks. Test the wheel for balance; if it is out, correct the balance or select another wheel.

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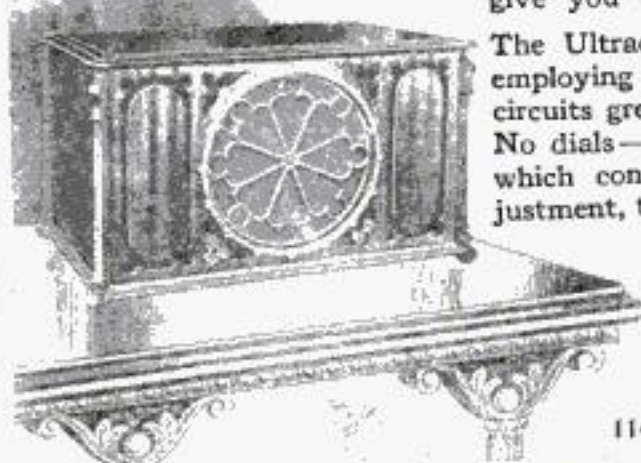
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A new artistic form of a radio receiver that blends happily with every scheme of interior decoration. Pleases the eye with its charming lines, its beautiful two-tone mahogany cabinet, its fine proportions. Has the appearance of a decorative tablepiece. Utter simplicity with superb receptive and reproductive qualities. Your local radio dealer will gladly give you a demonstration of this new receiver.

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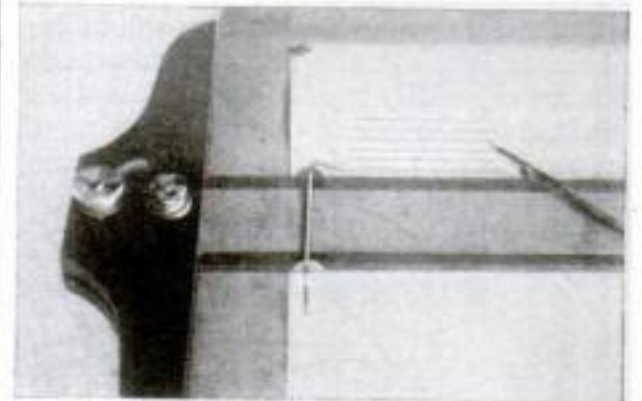
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CONDENSER AND RADIO CORPORATION

## Better Shop Methods

### Draftsman's Ruling Gage Attached to T-Square

FOR ruling evenly spaced lines with a T-square, a gage may be made as shown from a strip of thin metal and a wire pointer, which is bent and sharpened at one end. The pointer is retained in any



The spacing gage consists merely of a wire pointer and a thin, springy metal holder

position by the springiness of its holder. The device may be left on the T-square, slipping up to the head when not in use.

This guide has two advantages over the perforated triangle type—it can be used when lining directly in ink and it can be adjusted to any spacing desired.—  
HAROLD E. BENSON.

### How to Make Special Reamers in an Emergency

RESTORING a hand reamer to size in an emergency may be done by the method illustrated in Fig. 4 below. A file with one edge rounded slightly at the end is rubbed back and forth with considerable pressure on each of the cutting edges, throwing up or burnishing a small burr that will make the reamer do for a few more holes.

Reamers made of drill rod in the shop are shown in the other views. Figure 1 is



Three types of shopmade reamers and how to enlarge an under-size standard reamer

a machine reamer that is efficient and costs little to make. It is made of drill rod the size of the hole, hardened, and ground on the end. The reamer shown in Fig. 2, sometimes called a D-reamer, is useful for reaming a crooked hole.

Figure 3 shows a finishing reamer, and if the beveled edge is honed very keen, it will produce a smooth hole either in a machine or by hand.—S. W. BROWN.

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- |                 |                         |                                    |
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| 3. Tail Stock   | 11. Base 25 in. x 6 in. | 19. Drill Handle                   |
| 4. Centers      | 12. Saw Table           | 20. Drill Bits                     |
| 5. Chuck        | 13. 6-in. Circular Saw  | 21. Nut and Washer                 |
| 6. Spur Center  | 14. 2-in. Wheel         | 22. Steel Cover                    |
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## Better Shop Methods

### Two Tools that Save Time in Laying Out Work

**LOCATING** accurately the center line of a bar or structural angle can be done almost instantly with the tool shown in Fig. 1. It consists of three links of exactly the same length attached with small screws to the side angles. The middle link has a scriber point set precisely in the center. To use the tool, it is

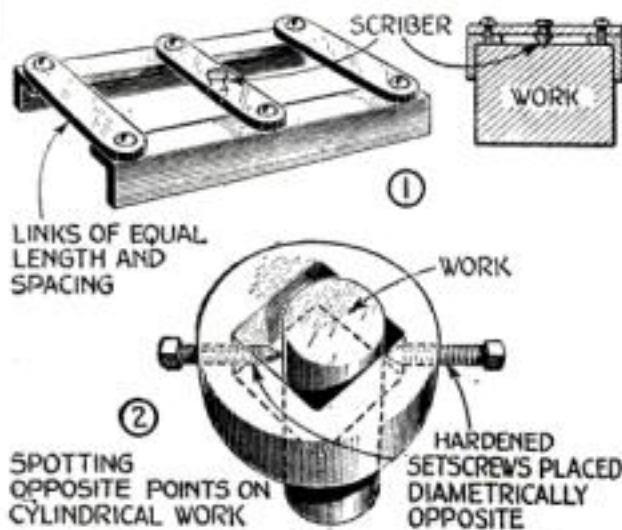


Fig. 1 is a tool for scribing a center line; Fig. 2 is used for locating points on round stock

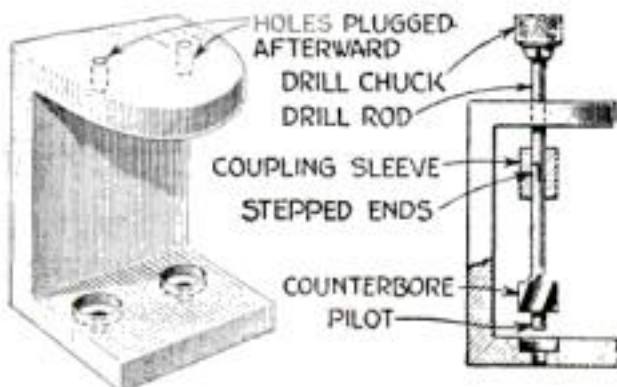
placed over the bar and closed with the fingers so both angles touch the edges of the work. Moving the device along scribes a line on the center of the bar.

Figure 2 is a tool used to locate diametrically opposite points on a shaft or bar. It is made by broaching a square hole large enough to go over the shaft in a steel block, and drilling and tapping for two special hardened setscrews. The drilling of these holes must be very accurately done.—G. A. LUERS.

### Counterbore Designed for Inaccessible Places

**A COUPLING** for a counterbore shank solved the difficult machining problem illustrated. The two holes in the lower part of the casting shown in Fig. 1 were to be counterbored from the inside.

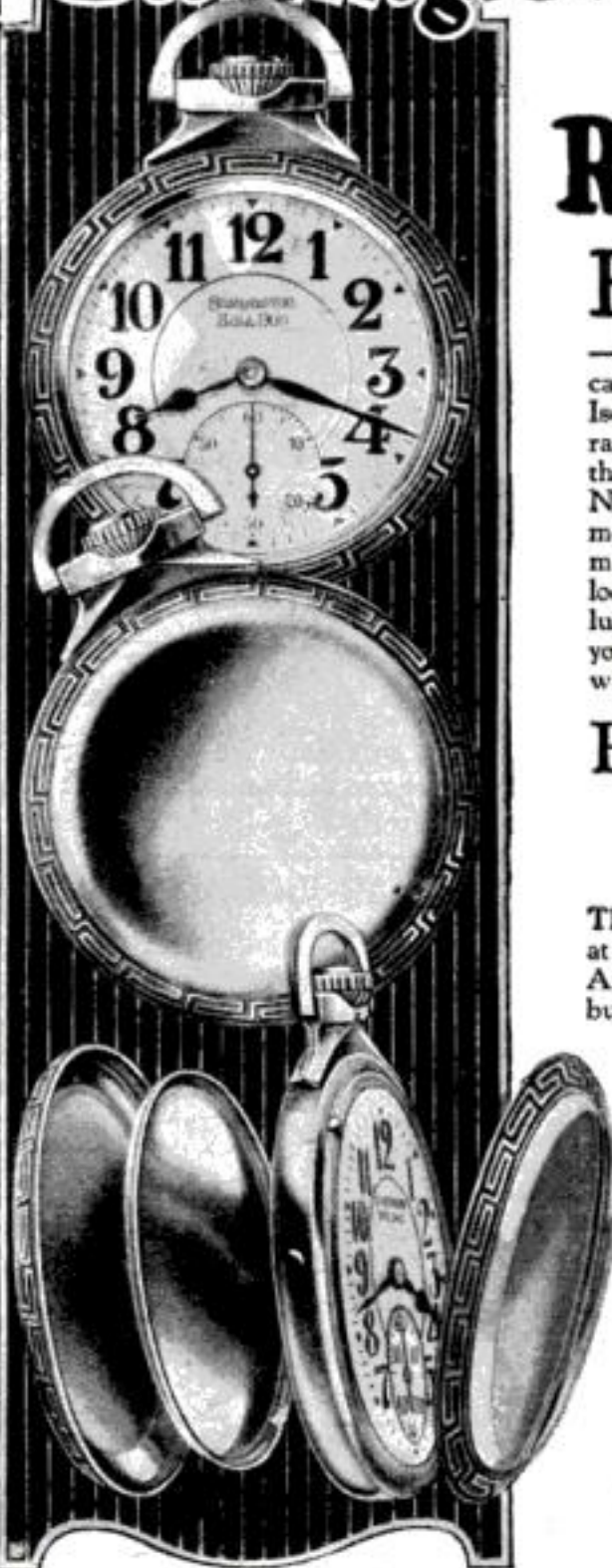
A counterbore was made with a  $\frac{1}{4}$ -in. shank and shaped at the end of the



How a machinist solved the difficult problem of counterboring holes located beneath a projecting part of a machine casting

shank as shown. A piece of  $\frac{1}{4}$ -in. drill rod was flattened to correspond and a coupling made of a piece of  $\frac{3}{4}$ -in. cold-rolled steel with a  $\frac{1}{4}$ -in. hole through it completed the tool. Two holes, which afterward were plugged, were drilled in the upper part of the casting to permit the extension shank of the counterbore to go through.—GEORGE BENDER.

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## Better Shop Methods

### How You Can Earn Money for Photos of Ingenious Tools

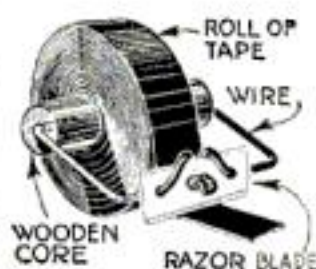
FOR interesting photographs of time-saving tools and fixtures, POPULAR SCIENCE MONTHLY is making a special offer of \$4 each.

If you are a mechanic, no doubt you have made at some time or other an especially useful or unusual tool or fixture to accomplish work that could not be done so easily with your regular tools. The chances are there was nothing on the market you could buy to serve the purpose of the tool you made, and, although it may have given service only on a few occasions, it probably paid for itself many times in a short period.

If you have made such a tool, send a clear photograph of it, with a brief description of its construction and purpose, to the Editor, Better Shop Methods Department, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York. For each photograph available for publication, POPULAR SCIENCE MONTHLY will pay \$4.

### Holder for Friction Tape

WHEN friction tape is used constantly, as in a garage, it is desirable to have some sort of cutter for it. Otherwise a thread often is pulled from the whole roll when a length is torn off.



An old razor blade serves as the cutter

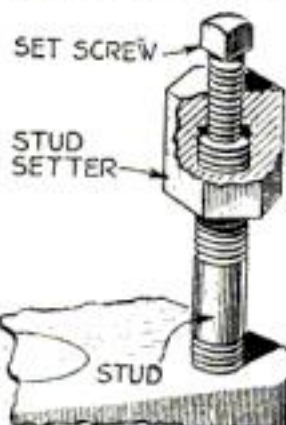
The simplest type of holder is a piece of heavy wire bent through and around a razor blade, as shown, and fastened into the end of a round stick. The upper edge of the razor blade is dulled for safety's sake. In use, the roll of tape is mounted on the stick and the tape is torn off as needed against the razor blade, while the roll and wire are held in a steady position throughout the business of using the tape.—ARTHUR FLINER.

### Setscrew Type of Stud Setter

IN SHOPS where a great many studs are set, as in assembling pumps, the stud setter illustrated is well worth making.

It consists of a short length of hexagonal steel drilled and tapped at one end to fit the stud and at the other to take a setscrew.

The device is screwed on to the end of the stud loosely and the setscrew is tightened down. A wrench then may be applied and the setter turned into place. When the setscrew is loosened, the stud setter may be removed easily.—



Stud setter designed for easy removal



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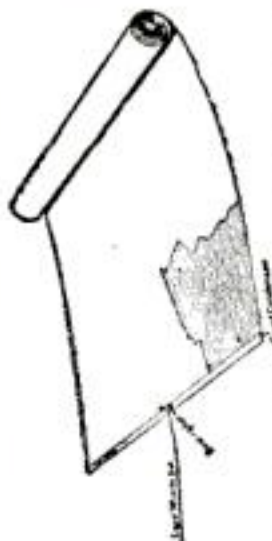
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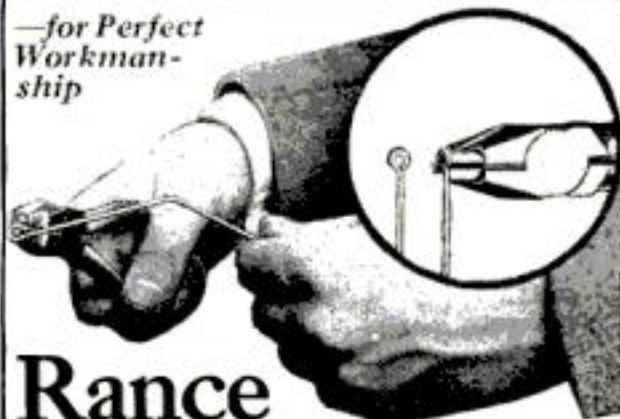
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## Better Shop Methods

### How to Build Foundations for Heavy Machine Tools

By H. L. Wheeler

ALL heavy machinery, such as lathes, planers, and horizontal milling machines, should rest on substantial foundations. In shops that occupy more than one floor it is a matter of elementary knowledge, of course, to place the heavy tools on the ground floor as far as possible and preferably on a rock or concrete base. They then are left unaffected by vibration and strains caused by the settling of the building itself, which might disturb the alinement.

So costly are most big machines that the foundation on which they rest cannot be too carefully made. When a fine machine tool is set carelessly on a wooden floor, which occurs more frequently than one might imagine, there is not much chance that the accurate alinement of the machine will be retained for any great length of time. Unless the building is of modern steel and concrete construction, every large machine should rest directly on the ground, if it is at all possible to find the necessary space on the ground floor.

Building a foundation is mainly a matter of good judgment based upon ex-

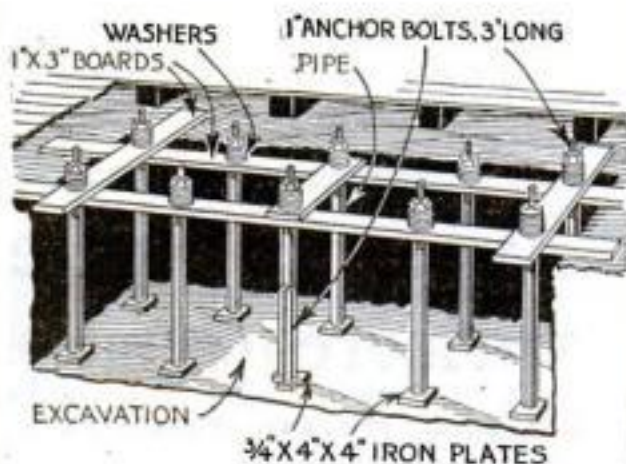


Diagram showing excavation with anchor bolts ready for the concrete to be poured

perience. First determine the size of the foundation, which should be at least 3 in. outside of the machine base all around. Then make a board frame and lay out and drill bolt holes, being careful to take exact measurements from the bolt holes in the machine base. If the bolt holes in the machine are  $1\frac{1}{8}$  in., make the holes in the boards to accommodate  $\frac{7}{8}$ -in. anchor bolts.

After fixing the location of the machine, rip up the floor boards and make an excavation from 3 to 5 ft. deep in the earth. The depth is governed to some extent by the nature of the soil. In cases where rock is found, it will not be necessary to dig down at all; simply level off the rock if it appears to be firm and solid.

Make the anchor bolts long enough to suit the excavation. A piece of pipe is used over each bolt. If the bolt is  $\frac{7}{8}$  in. in diameter, use  $1\frac{1}{2}$ - or 2-in. pipe. Cut all the pipe the same length and put the bolts through them with an anchor plate at the bottom of each bolt. The anchor plates are flat pieces of boiler plate.

The board frame then is placed in

(Continued on page 133)

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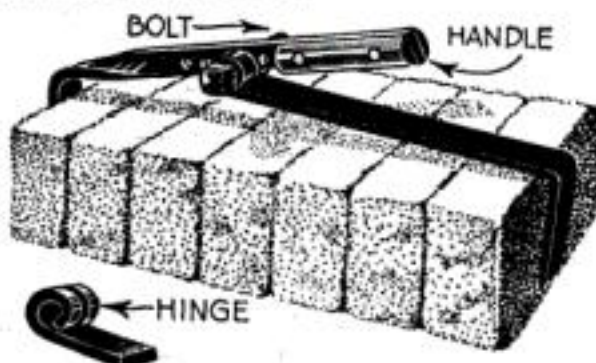
## Better Shop Methods

### Steel Tongs Speed Up the Handling of Bricks

**BRICK-TONGS** made as illustrated save time in handling bricks. They are made from two pieces of steel  $\frac{1}{4}$  by  $1\frac{1}{4}$  in. and about 19 in. long. These pieces are bent as shown, a handle is put on, and they are hinged together with a bolt. Several holes are drilled for the pivot bolt so as to accommodate bricks of varying sizes. The seven-brick size is the most practical, as two pinches of brick will equal the width of a wagon box.—**SIXTEN N. SWENSON.**



A "pinch" of seven bricks easily handled



Two pieces of  $\frac{1}{4}$  by  $1\frac{1}{4}$  in. steel, a bolt, and wooden hand grips are the only parts

### Foundations for Machines

(Continued from page 132)

position over the excavation and the bolts with the pipes and plates are hung in position as illustrated. Put about six washers on each bolt and adjust the height with the nuts. Any surplus length can be cut off after the machine finally is set and tightened down. The purpose of the pipes is to allow plenty of freedom after the concrete is poured.

A rich cement with crushed stone as an aggregate is poured into the excavation after the measurements have been checked to make sure that the bolts are placed properly. When the excavation is filled up to within about 2 in. of the top, a box form is built around the top as far as the floor level. The remainder of the concrete then is poured and the foundation is allowed to set for 48 hours or more.

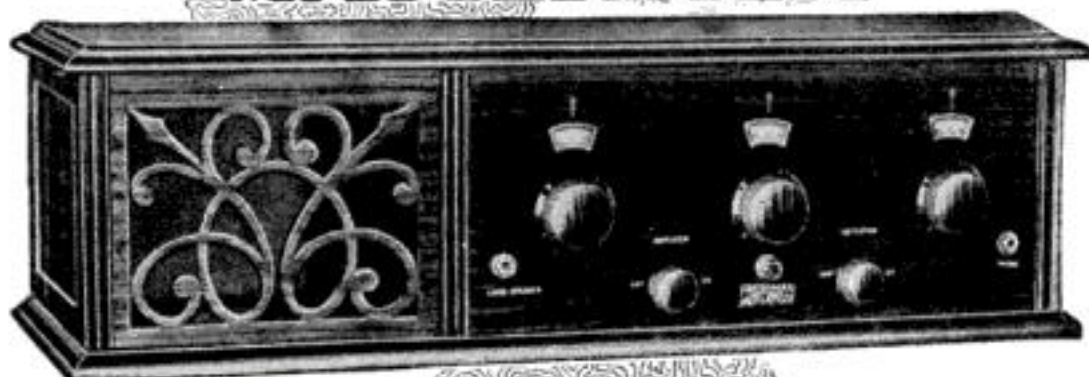
The machine is moved on rollers until it is in a position directly above the foundation bolts, unless a crane is available to lift it bodily. It is let down so that its weight rests on the concrete and then is leveled with iron wedges.

When it is perfectly level and bolted down and the setting has been rechecked, the machine is grouted in with cement. The mixture is poured on top of the concrete and smoothed off level with the floor. The cement must be run well under the edges of the machine base. In tightening down the bolts, take off all but two washers and cut off the surplus length of the bolt.

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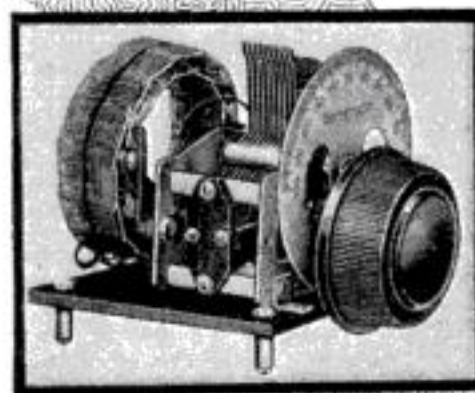
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Instrument \_\_\_\_\_

**WURLITZER**

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## How Daring Men Struggled to Lift the Sunken S-51

(Continued from page 11)

radio, your new fog-bearin's, and other schemes to make navigatin' easier.

"A rigger's job it is—much of it—for a man must know his blocks and his straps, and the pull he gets from any set o' tackles. Which is to say that there's plenty of sailorizin' in it. And the harder the job, I might say, the better we like it. Every wreck is a new problem.

"THE divers have it better now than they did when I started in the business. For one thing, we've the decompression tank, that a man goes into when he comes up. This gives him pressure, same as he's been getting on bottom, and then tapers off, bit by bit, till he comes to normal. Feed him a little helium, too, along with it—the stuff that was in th' poor Shenandoah—for that eats up nitrogen and such-like gases that overload a man's blood. 'Tis so they keep off the bends—somethin' that hits the nerves like sciatica, only a whole lot worse.

"There's all sorts of divers. I had a Greek with me once who'd go down bare-naked, any time, with a line, if our gear was late comin' or anyways out of order. They're mostly Swedes and Norwegians nowadays—fine, strong men—but this Andy, which was as near as I got to his right name, was a good one. His place is still waitin' where he left to go home for the last war, but it's not likely he'll ever be claimin' it now.

"I'd another one who'd go on th' drink now and again. That don't do for most divers, but this one was strong; he lasted a long time. He was down one mornin', and he didn't answer our signals. Thinks I, that's the last o' him. for I thought he'd had a few the night before. After a bit o' signalin', we sent down a second man, o' course keepin' up the pumpin' for both. Well, there on deck, fathoms down, was our friend, with his lifeline made fast so we might pull our heads off and not bother him—and him curled up comfortable, sleepin' it off. 'Twas one way of soldierin' on a job, though some might not take to it!

"WEATHER? Oh, ay, you get that, all right, and sometimes it holds you back, same as it did our men on this submarine. When the big derricks get rollin' in a seaway, it's about useless to try a liftin' job. And for pontoons—ye need smooth water for them. Some o' the tanks are pretty big to get 'em filled with water and then sink 'em just so alongside a vessel's hull or on top of her, accordin' as she may be lyin'. Next, you must make 'em fast where they'll do their best liftin', and then blow 'em clear with air. That's a job that can't be done with half a gale blowin' and a sea runnin'.

"Well, the stiffest job I ever remember handlin' was the Emma Crowell, some years back. Loaded with case-oil, she was; I forget how many thousand gallons. A brand new ship and hardly clear of New York Harbor before she caught fire, somehow.

(Continued on page 135)

## A Christmas gift for pipe-smoking bank presidents—and others

What better example of the true Christmas spirit than this letter of Mr. Johnson, a Nebraska bank president:

Larus & Bro. Co.  
Richmond, Virginia  
Gentlemen:

One of my customers presented me, at Christmas time, with a half-pound tin of Edgeworth, out of appreciation for services rendered in probating of his father's estate.

In thanking him for the gift I told him that it appealed to me for two reasons—the spirit in which it was given, and the fact that he remembered the kind of smoking tobacco I have used for the past ten years. He made use of an expression which will interest you and which appealed to me.

The expression used was, "Us fellows who smoke Edgeworth never forget one another."

Very truly yours, J. V. Johnson.

Of course in this case, Edgeworth happened to be the recipient's ten-year favorite tobacco. But in other cases, the gift serves as a happy introduction to Edgeworth.



To make it still easier for "us fellows who smoke Edgeworth never to forget one another," the 16-ounce glass humidor jar and the 8-ounce tin are provided at Christmas time with appropriate wrappings. Each size contains Edgeworth Ready-Rubbed and is

packed in a decorated gift carton printed in colors.

Please ask your tobacco dealer for the Edgeworth Christmas packages. If he will not supply you, we gladly offer the following service to you:

Send us \$1.65 for each 16-ounce jar, and 75c for each 8-ounce tin to be shipped, also a list of the names and addresses of those you wish to remember, with your personal greeting card for each friend.

We will gladly attend to sending the Christmas Edgeworth to your friends, all delivery charges prepaid.

**Personal:** If you are not personally acquainted with Edgeworth send your name and address to Larus & Brother Company, 10 L South 21st Street, Richmond, Va. We will send you free samples—generous helpings both of Edgeworth Plug Slice and Edgeworth Ready-Rubbed.

Edgeworth is sold in various sizes. Both Edgeworth Plug Slice and Edgeworth Ready-Rubbed are packed in small, pocket-size packages, in handsome humidors, holding a pound, and also in several handy in-between sizes.

**To Retail Tobacco Merchants:** If your jobber cannot supply you with Edgeworth, Larus & Brother Company will gladly send you prepaid by parcel post a one- or two-dozen carton of any size of Edgeworth Plug Slice or Edgeworth Ready-Rubbed for the same price you would pay the jobber.





## Carol

Far out over hill and valley—into the homes of rich and poor alike—come the waves that carry the glad tidings of the Savior's birth. Little does it matter whether the set is of new mahogany and gold or of humble cardboard coils. Tonal beauty in the amplifier is the one indispensable need for the real joy of radio. Happy indeed is the owner of Rauland-Lyric!



### A New Gift for Every Radio Listener

Two Rauland-Lyrics in this beautiful holiday box (fully sufficient for any radio set). See it at your dealer's!



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4201 W. Belmont Ave., Chicago

**Rauland-Lyric**  
ALL-AMERICAN  
TRADE MARK  
TRANSFORMER  
The Choice of Noted Music Critics

## How Daring Men Struggled to Lift the Sunken S-51

(Continued from page 134)

"Any fire at sea is bad enough, but oil—well, did you ever see one of those big shore-tanks go up? A man on land can run over into th' next county if things get too warm, but that's somethin' you can't do aboard ship; anyhow, not while there's half a chance left, for you've little of anywhere to run to.

"There was a fresh breeze goin', and the *Crowell* must have gone fast. Still, her crew managed to put up a good stiff fight, from what I heard, even with all hell roarin' down her deck. At last it got too hot, so they grabbed up her papers and took to the boats—and small wonder.

"HER master reported her a total loss, but she was a valuable ship and the underwriters wouldn't believe it. They came down for us and our president says, 'Mac,' says he, 'can we do anything?'

"'Well,' says I, 'we can have a look, anyway.' And out we went.

"She was worth seein', when we got to her. Spars and riggin' all gone, and fire still roarin' hot. We shoved our boats over to her and went at her with steam hose. Two days of it, steady, with no shifts, but all hands turned to from start to finish. Wouldn't have licked her then, only for a lucky thing. When she burned down to her rails, she let in the sea and flooded herself. That held the fire off her cargo oil and at the same time all those tin cases below helped to keep her afloat. On account of that, we finally beat th' fire.

"Both her anchors were down, and nothin' left in her to heave 'em up again. One of our gang was astride a cable, plannin' to slip it, when it snapped and hove him into the air like a chip. It was only luck that he missed our decks, comin' down, and was no worse for a good duckin' that made him watch his step for a bit.

"And then we got our lines on her and worked her up the bay, tied her up, and called it a job.

"BUT talkin' about weather, fog's as bad as anything, when you're lookin' for a wreck. Remember the time the old *St. Paul* ran ashore on the Jersey coast?

"She'd been feelin' her way through a thick night and that mornin' th' leadsman sung out '17 fathoms' when he only had 'seven.' A man might make that mistake when he's hurryin' his soundin's, for both are marked the same—a red rag. He thinks 10 fathom more has run out—and the next they know on the bridge, there they are, hard and fast.

"They rolled me out that mornin', when the word came, and the first thing I heard was how another company's gang had an hour's start on us.

"'Well,' says I, 'maybe 'tis as thick where they are as it is here—and anyhow we've the legs o' their boat.'

"So we had. And away we went, jammin' our tug down th' coast for all that was in her. You understand I was

(Continued on page 136)



## New Type of Speaker— "All-Directional"

ALWAYS pointed in the right direction. Always strong and clear in tone, no matter where you are in the room. It took N & K, pioneers in acoustics, to bring about this revolution in speaker construction.

This newest N & K speaker stands 9½ inches high on a square 6½ inch base. It is made of burtex, a scientific material which eliminates false tone vibrations. It contains the famous N & K diaphragm unit, adjustable to every local broadcasting condition and variation in receiver construction. Its tone is clear, natural and lifelike. Its volume is equal to that of speakers costing several times as much money. Yet the price is

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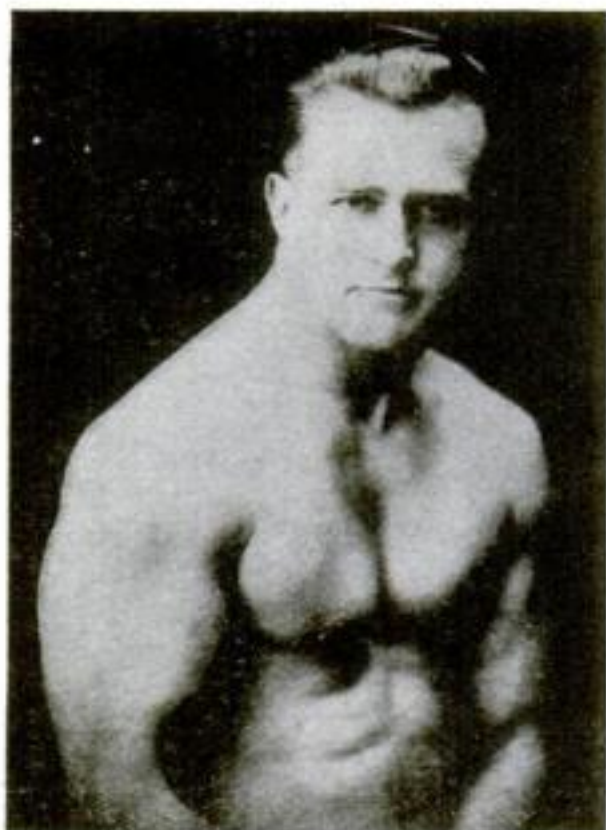


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### 5 Cents a Piece

Wouldn't it be great if we could buy muscles by the bag—take them home and paste them on our shoulders? Then our rich friends with money to buy them, would sure be socking us all over the lots.

But they don't come that easy, fellows. If you want muscle you have to work for it. That's the reason why the lazy fellow never can hope to be strong. So if you're lazy and don't want to work—you had better quit right here. This talk was never meant for you.

### I Want Live Ones

I've been making big men out of little ones for over fifteen years. I've made pretty near as many strong men as Heinz has made pickles. My system never fails. That's why I guarantee my works to do the trick. That's why they gave me the name of "The Muscle Builder."

I have the surest bet you ever heard of. Eugene Sandow himself says that my system is the shortest and surest that America ever had to offer.

Follow me closely now and I'll tell you a few things I'm going to do for you.

In just 30 days I'm going to increase your arm one full inch. Yes, and add two inches to your chest in the same length of time. But that's nothing. I've only started; get this—I'm going to put knobs of muscles on your shoulders like baseballs. I'm going to deepen your chest so that you will double your lung capacity. Each breath you take will flood every crevice of your pulmonary cavity with oxygen. This will load your blood with red corpuscles, shooting life and vitality throughout your entire system. I'm going to give you arms and legs like pillars. I'm going to work on every inner muscle as well, toning up your liver, your heart, etc. You'll have a snap to your step and a flash to your eye. You'll feel the real pep shooting up and down your old backbone. You'll stretch out your big brawny arms and crave for a chance to crush everything before you. You'll just bubble over with vim and animation.

Sounds pretty good, what? You can bet your old ukelele it's good. It's wonderful. And don't forget, fellows—I'm not just promising all this—I guarantee it. Well, let's get busy. I want some action—so do you.

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Dear Sir:—Please send me without any obligation on my part whatever, a copy of your latest book "Muscular Development." I enclose 10 cents to cover cost of mailing and wrapping. (Please write or print plainly.)

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City..... State.....

## How Daring Men Struggled to Lift the Sunken S-51

(Continued from page 135)

wreckmaster, not cap'n of the boat, and her skipper says to me, 'Cap'n, I don't like this runnin' four bells an' a jingle when I can't see where I'm goin'.' 'All right, cap'n,' says I, 'you go down in th' bow and then, if we hit anything, you can step off nice and comfortable.'

"All the same, I was mighty glad, too, when we found old Shrewsbury buoy under our forefoot where we wanted her, and knew just where we were. Pretty soon after that, there was the ship loomin' up, stuck in about 13 foot o' water, for'ard. Felt better, then, when I heard the other gang had missed her somehow, and gone too far to sea.

"Well, we got our lines aboard her, run out anchors, and hooked on. By that time the fog had lifted some, and the passengers were transferrin' to another liner that had been sent down on account of business men bein' held up, and opera singers takin' cold, and so on.

"THAT'S the regular thing, but did you ever mark how the passengers go off growlin' at the steamship company and damnin' the ship's commander just when th' heart's knocked out of him through spottin' a fine record of maybe 30 years' standin'? 'Tis so it goes.

"No, sir, we didn't get her off—not even with the other gang's tug helping after she turned up. It was a case of lighten ship—hoist her boats out, cut off her davits, and rouse up cargo. She carried about a million and a half in gold, that run, and—"

Captain Mac interrupted himself to chuckle, and then went on:

"Ye mind, this was before the hold-up days. Plenty o' gales but no crime waves! We just shoved that gold under a tarpaulin in a boat with two or three men and sent her up to the city. Take a regiment o' marines, likely, nowadays, to put that gold in bank!

"Well, in a case like that, gettin' a ship off means havin' lines out, bow or quarter, or both, and good anchors laid just so, to take the strain. Then you haul away—and hold—and haul again—to make nothin', sometimes. And on top o' that the wind may make from the wrong bearin' and carry away the whole business so you have to begin again. It was my good luck we caught the right breeze that day, to walk the *St. Paul* off nice and easy, and leave her not much the worse."

SO IT goes with Captain Mac and his fellow salvors. First they have a job of straight lifting, like the 51. Next, it is a big ship to haul off, or a diving and torch job or, again, a case where a patch can be bolted over a stove-in hull to make it tight. Then, perhaps, the water can be blown out of compartments and replaced by air that must bring the ship up. But, as Captain Mac reminds us, the pressure must be reduced regularly as she rises, or "she'll blow her deck loose as she hits th' surface and go down again like lead."

It all takes practice and experience, as the same veteran pointed out to the navy

(Continued on page 137)



## Buy Christmas Seals

Stamp Out Tuberculosis



The National, State and Local  
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Write today for 168 page FREE book giving full particulars and testimonials from hundreds of grateful users whose hearing has been restored by use of our "little wireless phones for the ears."

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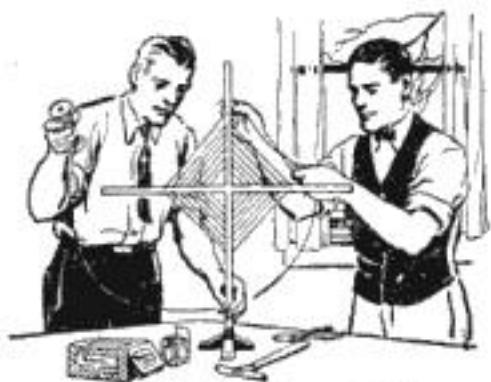
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**\$100 in Prizes**

See Cash Prize Offer on Page 4  
in front advertising section

## How Daring Men Struggled to Lift the Sunken S-51

(Continued from page 136)

men in '98 when he was wreckmaster at Santiago discussing the sunken Spaniards.

"Best let our gang go at 'em in their own way, without too much help. A navy man's brought up different—'tis his job to sink the other man's ships—not raise 'em!"

There is certainly a lure to the game, with its ever-different jobs and their possibilities—a lure that brings to it men of every color and every race, to hold them until they lose an arm in a jammed tackle or burst a blood-vessel 100 feet under water. You find ancient, retired divers hanging about the salvor's docks, and long-pensioned wreckmasters listening in the night for the emergency call that may find all the active men at work elsewhere and only themselves available.

Perhaps the charm began 'way back in history, when the words "flotsam" and "jetsam" first came into the language; or when neighboring British towns quarreled over the ownership of a barrel of whisky afloat in the bay adjacent to both. Certainly that charm has come down through the galleons of the Spanish Main to our own day of the *Laurentic* and *Lusitania*; adventure and treasure-hunting, always fostered by the sailor's refusal to be beaten by the tireless, unchanging sea.

**Y**EAR by year, the tonnage restored to service by the salvors rolls up into the millions. Frequently, too, they do a life-saving job by being the first on hand or by backing up, with their powerful ocean-going craft, some little coastguard cutter's valiant tugging at a big schooner or steamer, disabled in the breakers' grip. An exciting game, and worth playing.

"It never lets a man alone, no matter where he is," said another old-timer. "Why, there was a young feller in the business for himself, with a small crew—Dan, we all called him. Seems he was down in Nassau, one time, on a holiday, with a wife he'd married three days before.

"In comes word of a tanker thrown up around Cat Island somewhere, and what does he do? All off with the honeymooning and away in a motor-boat with the wife, to be first on board.

"She was abandoned, when they got to her—all hands gone in the boats, radio carried away, boilers under water, and all the rest of it. But he sends back his boat, with a cable for his crew and another making a bid for th' job, and then the two o' them sit down to see nobody walks off with their ship.

"Ten days or so they was out there, hanging by their teeth to that reef through one gale that mighty near broke the ship's back under their feet. But in the end they got the job all right—and when the crew come down—they did it!"

## Are You a Radio Fan?

Then you won't want to miss the remarkable cash prize radio contest on page 58 of this issue. Here's an opportunity to build a fine receiver for yourself, and at the same time to be rewarded handsomely for your trouble.

**\$8.00 Value for only \$2.95**  
**Send No Money PLUS POSTAGE**

This is the most wonderful offer we have ever made. The card case alone if purchased elsewhere would cost you \$8.00. Our price is only \$2.95, and for good measure we give you, free of charge, gold stamping worth \$1.50 and a Chinese Lucky Ring worth \$1.50.

Note: We cannot make any reduction in price if ring and gold stamping are not wanted.

**Give a Card Case For Xmas**

13 in 1 combination card case, value.....\$5.00  
Gold stamping, name, town, state and lodge emblem.....1.50  
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**AGENTS WANTED** If you act at once



**13 in 1 COMBINATION CARD CASE  
THE IDEAL CHRISTMAS GIFT**  
**Guaranteed Wear-Ever**  
**—GENUINE— Calf-Skin**

This 13 in 1 Combination Card Case has thirteen separate features, viz., 8 Windows for Lodge Receipts, Membership Cards, Passes, etc., 3 Pockets for Cards, Memos, etc., 14 Change Pockets with a snap Button Flap and 1 Bill Pocket. It is made of Genuine Wear-Ever Calf-Skin Leather and is not to be confused with the cheap sheepskin card cases now on the market. Turned edges, hand tooled, strongly stitched. Size closed 3 1/2 ins. x 4 3/4 ins.

**Gold Engraving FREE**  
We engrave your name, address (two lines) and lodge emblem in 23-carat gold, absolutely free. This work alone is worth \$1.50. The engraving gives the card case a very classy appearance and will be the means of identifying it lost or stolen.

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We want every one of our customers to have the best of luck and just to give them up a bit we will include with every card case sold one of these Chinese Good Luck Rings. A platinum ring with heavy black enameled top and embossed Chinese lettering in white, meaning "Good Luck." This ring is said to be almost unbreakable in its power to bring "Good Luck, Health, Wealth and Happiness." Marvellous stories of good fortune are told by its wearers. It sells for \$1.50, but we give it to you absolutely FREE OF CHARGE when you purchase a card case.

**SEND NO MONEY**

You surely must have one of these card cases, and also the free Chinese ring. Remember, we do not ask for one penny in advance. Just fill out the coupon and pay the postman \$2.95 plus a few cents for postage when the package is delivered. Money back if not satisfied. You risk nothing. Send the coupon today.

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Send me the genuine leather card case shown above, with my name, town, state and lodge emblem in gold engraved absolutely free. Also include a Chinese Lucky Ring free. When the package arrives I will pay the postman \$2.95 plus a few cents to cover postage. If I am not fully satisfied, I will immediately return the case and the ring and you will return my money.

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Readers of POPULAR SCIENCE MONTHLY will find scores of opportunities in this section (pages 138 to 166) for making more money.

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My Employment Dept. helps  
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Does your present job offer you a FUTURE? If so, how long must you wait for that future? Five?—ten?—fifteen?—perhaps twenty years? TOO LONG to wait for an uncertainty! Too many things can happen in that time to rob you of the fruits of your hard, earnest labors. GET WHAT YOU EARN—now! Drudging through the years in hopes that mere chance will provide a big future for you is like wandering in a fog with little prospect of reaching your destination.

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# COYNE

## ELECTRICAL SCHOOL

H. C. LEWIS, President

Established 1899

1300-10 W. Harrison St. Dept. 1369 Chicago

There is no Substitute for Personal Training,  
in Great Shops, on COMPLETE Apparatus

Send For My Big Free Book and  
Great Offer of 2 Special Courses  
Without Extra Cost

Surprisingly Large, Handsome and  
Complete Electrical Book Costs You  
Nothing, Now or Later

I've just printed a great big, handsome, two-color Electrical Book that I want to send you at once. It is 12x15 in size and contains 161 actual photos of electrical scenes and operations. Tells about dynamos, radios, autos, airplanes, farm lighting and power, etc. Nothing like it. You'll be amazed. ABSOLUTELY FREE. REMEMBER.

### SEND COUPON NOW

H. C. LEWIS, President  
COYNE ELECTRICAL SCHOOL  
1300-10 W. Harrison St.  
Dept. 1369 Chicago, Illinois

Dear H. C.—You can just bet I want one of those big, handsome FREE 12x15 books, with 161 actual photographs printed in two colors. Send it quick, before the supply is exhausted. Be sure to tell me all about Special Offer of 2 Big Courses without extra cost.

Name \_\_\_\_\_

Address \_\_\_\_\_

### True Stories of Success

(Continued from page 4)

DEAR EDITOR: Having looked over the ads in the Money Making Opportunities Department I find that the ad of Ralston University Press, on page 151, appeals to me above all others.

About 12 years ago, I received a diploma from the International Correspondence Schools, on Electric Lighting and have followed wiring until last year, when I opened a store of my own. Having tested a correspondence course I know that it pays. As I find myself coming in contact with the public all the time, I realize that my greatest need now for success is Personal Magnetism. Am writing tonight to Ralston University Press to take advantage of their offer.—J. CLARENCE MAGUIRE, Macomb, Ill.

ANOTHER reader who recognizes the value of "salesmanship" is George S. Harris, whose letter about the National Salesmen's Training Associations is quoted below:

DEAR SIR: Every advertisement under "Money Making Opportunities" will render a service to the user. But when I count 17 friends, without previous selling experience, who have made good in the selling game following a few tips on "Modern Salesmanship," I am convinced that the National Salesmen's Training Association offers the best opportunity to any ambitious person who is trying to get out of a rut. My friend Marshall, once a drug clerk, is hitting over \$7000 a year, with less than two years' experience selling for the Service Appliance Company. He's out of the rut now. Salesmanship did it.—GEORGE S. HARRIS, Schenectady, N. Y.

That there is success and profit to be gained in whatever line of endeavor you have the greatest natural interest in is evidenced by this letter regarding the U. S. School of Music advertising:

CONTEST EDITOR: After reading all the advertisements under "Money Making Opportunities," the U. S. School of Music appealed most to me.

Two and a half years ago a friend wished to study music in a short time. One day she answered the U. S. School of Music's advertisement in POPULAR SCIENCE MONTHLY. After a few months of study she was able to teach a large class of pupils. Thanks to POPULAR SCIENCE MONTHLY for its worth-while advertisements.—ORPHA LEBO, Penbrook, Pa.

(Continued on page 140)





# A Personal Message to Men Who Want to Earn More than \$7,000 Every Year

By J. E. Greenslade

**W**HEN a civil service clerk earning only \$25 a week suddenly surprises his friends by increasing his earnings to nearly \$200 a week—when a farm hand earning only \$60 a month begins to earn \$1,000 a month—when a railway mail clerk earning \$1,600 a year changes his job and earns \$1,000 in thirty days—when hundreds of others quickly jump from small pay to magnificent earnings—then blame yourself if you do not do equally well.

There is nothing exceptional about any of these men. They'll tell you that themselves. Many had been clerks, bookkeepers, me-

chanics, farm hands—in fact, they came from all walks of life. And then in a very short period of time they found themselves making more money than they had ever dreamed possible. Today they know the thrill of money-making.

## I Pledge You My Word You Can Do It

What these men have done, hundreds have done, hundreds are doing today, and hundreds will do tomorrow. And you can be one of them. The same opportunity is yours with no possibility of your failing to do equally as well if you follow my advice.

But first let me tell you why the same opportunity exists for you. In 12 months the National Salesmen's Training Association received requests for more than 43,000 salesmen from wholesalers, manufacturers, and jobbers—representative concerns all over the United States and Canada. Surely that is a tribute to the manner in which we train men for Master Salesmanship.

There are countless openings for men who really know how to sell—unlimited opportunities to make real money. And once you possess the secrets of Master Salesmanship you, too, can do equally as well as any of the men mentioned on this page.

## A Foolish Notion About Salesmen

For some reason the average man imagines that, in order to make good in selling, he must be a "born" salesman. Nothing could be further from the truth. There is no such thing as a "born" salesman.

There are certain principles, certain rules, certain secrets to selling just as there are certain principles in mathematics and medicine. Once you know these principles you can quickly make good in the selling profession.

And through the National Demonstration Method—an exclusive feature of our System of Training—you gain the equivalent of actual experience in overcoming sales problems of all descriptions. Then, through the N. S. T. A. System of Electives, you get

the proved selling plans of Master Salesmen in the line or lines you want to sell.

Step by step this result-securing system of salesmanship training takes you through every phase of selling, and secrets of selling that have made millions of dollars are unfolded to you in a manner so simple and easy as to be immediately grasped.

Then there is the Free Employment Service at your disposal when you are qualified and ready.

## Remarkable Book, "Modern Salesmanship" Sent—FREE

With my compliments I want to send you a most remarkable book, "Modern Salesmanship." It will show you how you can easily become a Master Salesman—a big money-maker—how the N. S. T. A. System of Salesmanship Training will give you the equivalent of years of selling experience in a few weeks; how our Free Employment Service will help you select and secure a good selling position when you are qualified and ready. And it will give you success stories of former routine workers who are now earning amazing salaries as salesmen. Mail the coupon today. It may be the turning point in your life.

## NATIONAL SALESMEN'S TRAINING ASSOCIATION

Dept. W-15  
N. S. T. A. Building  
CHICAGO, ILL.



National Salesmen's Training Association  
Dept. W-15, N. S. T. A. Building,  
Chicago, Ill.

Send me FREE your book "Modern Salesmanship," and proof that I can become a Master Salesman.

Name.....

Address.....

City.....State.....

Age.....Occupation.....

### Earns \$1,350 a Month

"Last month, I earned \$1,350 as a salesman. Have averaged \$1,000 a month the last year. I couldn't have done it without N. S. T. A. training."—A. H. Ward, Chicago.

### \$1,000 in 30 Days

"After ten years in the railway mail service I decided to make a change. My earnings during the past thirty days were more than \$1,000."—W. Hartle, Chicago, Illinois.

### More Than \$10,000

"Your training has enabled me to learn more, earn more and be more. I am now president of a national organization, and my earnings for 1925 will easily exceed the five figure mark."—Charles V. Champion.

### City Salesman

"I want to tell you that the N. S. T. A. Employment Department helped me to a good selling position as city salesman."—Wm. W. Johnstone, Jr., Minneapolis, Minn.

### \$554.37 in One Week

"Last week my earnings amounted to \$554.37; this week will go over \$400."—F. Wynn, Portland, Ore.

### \$100 a Week in Only 3 Months

H. D. Miller, of Chicago, made \$100 a month as stenographer in July. In September, 3 months later, he was making \$100 a week as a salesman.

### \$10,000 a Year

O. H. Malfrout, of Boston, Mass., stepped into a \$10,000 position as a SALES MANAGER—so thorough is this training.



## FASCINATING



... and perhaps you, like other ambitious men, due to the lack of money, time and education necessary to master difficult mechanical trades, wonder what you can get into quickly and make the most out of, now! Haven't you overlooked the very thing you are looking for?

For there is a profession begging for clean-cut, earnest men, like yourself! Look into it! 60,000 Moler graduates know Modern Barbering is easy to learn, inexpensive, quicker to earn, clean and FASCINATING! It pays better than you think! FIND OUT! Write for booklet C.

Address the branch of the MOLER SYSTEM OF COLLEGES nearest you  
(Street address not needed)

Chicago, Ill.	Detroit, Mich.	Memphis, Tenn.	Los Angeles, Calif.
New York, N. Y.	Denver, Colo.	Dallas, Tex.	Salt Lake City, Utah
St. Louis, Mo.	New Orleans, La.	Houston, Tex.	San Francisco, Calif.
Kansas City, Mo.	Omaha, Nebr.	San Antonio, Tex.	Tacoma, Wash.
Cincinnati, Ohio	Milwaukee, Wisc.	Minneapolis, Minn.	Portland, Ore.
Cleveland, Ohio	Atlanta, Ga.	Seattle, Wash.	Winnipeg, Man., Can.

# \$100 in Cash Prizes

See Page 4 in front of book for details



**Steady Work—No Layoffs—Paid Vacations**  
**Travel—See Your Country**  
**Common Education Sufficient**  
**Men, Boys, 18 to 45. Mail coupon today**

## \$158 to \$225 a Month

**ALL POSTAL SALARIES JUST RAISED**  
**MAIL COUPON IMMEDIATELY**

Franklin Institute, Dept. J-276, Rochester, N. Y.

Sirs: Send me without charge, (1) sample Railway Postal Clerk Examination questions; (2) tell me how to get a U. S. Government job; (3) send list of places at which examinations will be held and free sample coaching.

Name.....  
Address.....

## True Stories of Success

(Continued from page 138)

Harry A. Ortmann from his 14 years of practical experience strongly recommends specialized training to every one going into a trade or profession of a technical nature.

DEAR SIR: The Opportunity which interests me most is the "ad" of American Technical Society. Automobile Repairing is the real money job today, providing a man knows his business. Can you fix it? Yes, I can, but I could not say that if I did not have 14 years of experience.

A man may join an Auto School today, get his experience in six months' time and in a year he will be able to say he can fix it, because he is taught by book and by practical methods and does not have to pick it up himself. I wish there had been schools like this when I first broke into the Automobile Repairing Game—H. A. ORTMANN, West New York, N. J.

You don't have to work 14 years to gain the experience of the writer of the above letter. Intensive study will give you a quick start in trade you are interested in.

Fill in the coupons or write the advertisers who are ready to help you reach the top of the trade profession you have chosen. They are ready to help you as they have helped the men whose letters we quote above.

## Complete List of Prize Winners In the October Contest

### FIRST PRIZE \$50

Marteen Martin, Gatesville, Tex.  
(Coyne Electrical School)  
(Victor J. Evans)

### SECOND PRIZE \$25

Edmund B. Carlson, Brooklyn, N. Y.  
(International Correspondence School)

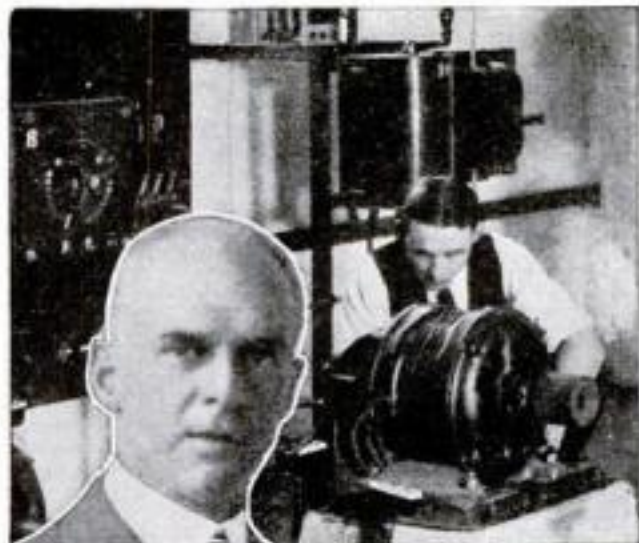
### THIRD PRIZE \$10

E. N. Tuckerman, Hartland, Wis.  
(Theo. Audel & Co.)

### PRIZE WINNERS who received \$1.00 each for their letters—

Josephine Hiers, Apopka, Fla.  
Chicago Engineering Works  
J. Clarence Maguire, Macomb, Ill.  
Ralston University Press  
George S. Harris, Schenectady, N. Y.  
National Salesmen's Training Assoc.  
Orpha Lebo, Penbrook, Pa.  
U. S. School of Music  
B. C. Brown, Dighton, Mass.  
International Corres. Schools  
Harry A. Ortmann, West New York, N. J.  
American Technical Society  
Mrs. R. H. Fischer, Orangeburg, S. C.  
Chicago Motor Training Corp.  
J. McGinnis, Cartersville, Ill.  
Chicago Engineering Works  
Mrs. A. E. Graham, Independence, Ia.  
Coyne Electrical School  
R. H. Gatiss, Kalispell, Mont.  
Theo. Audel & Co.  
Harry W. Whelan, Greenwich, Conn.  
Lionel Strongfort  
T. A. Musser, Altoona, Pa.  
Page-Davis Sch. of Advertising  
M. A. DeFord, Sausalito, Calif.  
G. & C. Merriam Co.  
Chas. P. Baker, Associated, Calif.  
American Technical Society  
Frank G. Davis, Harrisburg, Va.  
W. L. Evans Sch. of Cartooning





John Jirinec, Astoria, L. I., New York, makes \$12,000 a year



Automotive Electricity pays W. E. Pence, Albany, Oregon, over \$9,000 a year



J. R. Morgan, Columbus, Ohio, makes \$30 to \$50 a day in business for himself

## Electrical Experts Are in Big Demand I Will Train You at Home To Fill a Big Pay Job

### Electricity—the World's Big Pay Field

Electricity is the field of the greatest opportunities. In all other trades and professions competition is so keen from over-crowding that only the exceptional man can get to the top.

Not so in the Electrical line.

Here is a profession that is fairly bubbling with possibilities—with thousands of chances for wonderful success. We stand today on the very threshold of the real Electrical Age—an Age when everything now operated by steam or gas or horses, will be moved by Electricity. But it is an Age demanding specialists—trained men—Electrical Experts. Such men can easily earn from \$12 to \$30 a day.

Money is being poured into the Electrical Industry at the rate of a billion dollars a year. Think of it—a thousand million dollars a year for electrical expansion. This means—men—jobs—opportunities.

My big book the "Vital Facts" of the electrical industry and the wonderful opportunities that await "Cooke Trained Men" tells you all about this Big Pay Field.

**Mail Coupon for the Free Vital FACTS**

It's a shame for you to earn \$15 or \$20 or \$30 a week, when in the same six days thousands of men as Electrical Experts are making \$70 to \$200—they do it easier—not work half so hard. Why then remain in the small-pay game, in a line of work that offers no chance, no big promotion, no big income? Fit yourself for a real job in the great electrical industry. I'll show you how.

## Be an Electrical Expert Learn to Earn \$3,500 to \$10,000 a Year

Today even the ordinary Electrician—the "screw driver" kind—is making money—big money. But it's the trained man—the man who knows the whys and wherefores of Electricity—the "Electrical Expert"—who is picked out to "boss" the ordinary Electricians—to boss the Big Jobs—the jobs that pay \$3,500 to \$10,000 a Year. Get in line for one of these "Big Jobs". Enroll now for my easily learned, quickly grasped, right-up-to-the-minute, Spare-Time Home-Study Course in Practical Electricity.

### Age or Lack of Experience No Drawback

You don't have to be a College Man; you don't have to be a High School Graduate. As Chief Engineer of the Chicago Engineering Works, I know exactly the kind of training you need, and I will give you that training. My Course in Electricity is the most simple, thorough and successful in existence, and offers every man, regardless of age, education, or previous experience, the chance to get into this Big Pay Field where thousands of men easily earn \$70 to \$200 a week.

### Five Electrical Outfits FREE to Students

With me, you do practical work—at home. You start right in after your first few lessons to work at your profession in the regular way. For this you need tools, and I give them to you absolutely without extra cost—Five big complete outfits, that would cost \$12 to \$15.

### Your Satisfaction Guaranteed

So sure am I that you can learn Electricity—so sure am I that after studying with me, you, too, can get into the "big money" class in electrical work, that I will guarantee under bond to return every single penny paid me in tuition, if, when you have finished my Course, you are not satisfied it was the best investment you ever made.

### Guarantee Backed by a Million Dollar Institution

Back of me in my guarantee, stands the Chicago Engineering Works, Inc., a two million dollar institution, thus assuring to every student enrolled, not only a wonderful training in Electricity, but an unsurpassed Student Service as well.

It's this Service that makes "Cooke" training different from any other training. It's this Service, plus "Cooke" Training, that makes the "Cooke" Trained Man the "Big-Pay Man," everywhere.

Be a "Cooke" Trained Man. Thousands of them are earning \$70 to \$200 a week—\$3,500 to \$10,000 a year.

### Get Started Now—Mail Coupon

I want to send you my Electrical Book and Proof Lessons both Free. These cost you nothing and you'll enjoy them. Make the start today for a bright future in Electricity. Send in Coupon—NOW.

L. L. Cooke, Chief Engineer

**Chicago Engineering Works**  
2150 Lawrence Ave., Dept. 39 Chicago

### Use this Free Book Coupon!

L. L. COOKE, The Man Who Makes  
Dept. 39 "Big-Pay" Men  
2150 Lawrence Ave., Chicago

Dear Sir: Send at once, Sample Lessons, your Big Book, and full particulars of your Free Outfit and Home Study Course, also the Free Radio Course—all fully prepaid without obligation on my part.

Name.....

Address.....

Occupation.....

**The "Cooke" Trained Man is the "Big Pay" Man**



# Opportunities for Readers in Quick Action Advertising

## ADDING MACHINES

**FREE** trial, marvelous new adding machine. Adds, subtracts, multiplies, divides automatically. Work equals \$350.00 machine. Price only \$15.00. Speedy, durable, handsome. Five-year guarantee. Used by largest corporations. Write today for catalog and free trial offer. **Lightning Calculator Co., Dept. P, Grand Rapids, Michigan.**

## ADVERTISING SERVICES

**ADVERTISING** in 24 metropolitan dailies, 24 words, \$15.00. Helpful Guide listing 1000 publications, 4c stamps. **Wade Company, Baltimore Bldg., Chicago.**

24 WORD ad 355 rural weeklies, \$14.20. **Ad-Meyer, 4112P Hartford St. St. Louis.**

**COMBINATION** Winner. 125 Magazines, 10c word, \$8.00 inch. Thrive, Interstate Advertiser, Munsing, Mich.

**MR. ADVERTISER:** Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

**ADVERTISING** in all magazines and newspapers at publishers' lowest rates. Rate book free. **Taylor's Advertising Service, Dept. 5, Freeport, Ill.**

**INCH** display, 88 magazines \$2.00, thrice \$5.40. **Smith's Service, Wenatchee, Wash.**

## AUTHORS AND MANUSCRIPTS

**PHOTOPLAY**—Story Ideas wanted. \$25-\$500 p.w.d. Experience unnecessary; outline free to anyone. **Write Producers League, 312 St. Louis.**

**WRITERS**—Stories, poems, plays, etc., are wanted for publication. **Literary Bureau, 117, Hannibal, Missouri.**

**\$35** FOR Ideas. Photoplay plots accepted any form, revised, criticized, copyrighted, marketed. Advice free. **Universal Scenario Corporation, 214 Security Bldg., Santa Monica and Western Avenue, Hollywood, California.**

**SHORT** Stories, Articles, etc., typewritten and marketed. **Hush Service, Dept. 3, Box 1013, Harrisburg, Penna.**

**SONGS** and song poems wanted. **Radio Publicity Bureau, Box 24, Times Square Station, New York.**

**PHOTOPLAY** Writing Secrets 25c. (Coin) Circular, Press Publishers, Chazy, N. Y.

**I WANT** song poems. **Casper Nathan, J-3544 No. Racine, Chicago.**

## AUTOMOBILES AND ACCESSORIES

**DELIVERY** bodies for Ford Model T Chassis with enclosed cab, suitable for Contractors, Grocersmen and Farmers. Three styles. Price \$37.50. **Write Daniel Zimmerman, Craigville, Indiana.**

**FORD** size spark plugs guaranteed. Trial set (4) \$1.00 postpaid. **Benj. Jordan, 2803 Shelton Ave., New Haven, Conn.**

## AVIATION

**AVIATION** fans: Send one dollar for beautiful pair of Sterling Silver wings mounted on coat lapel pin with safety catch, also identification card issued by National Flyers' Association. Thousands of aviators, aviation mechanics and boosters are wearing these pins. **Wallace Aero Company, Bettendorf, Iowa.**

**LEARN** aviation! Flying; Mechanical; Home-study courses. Aeroplanes for sale. Send 25c for illustrated catalog and details. **Varney Aircraft Co., Peoria, Ill.**

The American School of Aviation announces a new correspondence course in mechanics of aviation. A thorough training in practical aeronautics. **American School of Aviation, Dept. 6741, 3001 Michigan Ave., Chicago, Illinois.**

**LEARN** Flying Right. America's Largest Strictly Commercial Organization. High class individual instruction without restrictions. Write for further particulars. **Johnsons' Flying Service, Inc., Dayton, Ohio.**

## BLUEPRINTS

TO the man who has a Home Workshop and likes to work with tools, **Popular Science Monthly** offers the opportunity to purchase blueprints giving details of the construction of useful articles for the home. The following are a few of the blueprints available: No. 1, Sewing Table, No. 5, Kitchen Cabinet, No. 13, Tea Wagon, No. 15, Workshop Bench, No. 17, Cedar and Mahogany Chest, No. 41, One Tube Radio Set, No. 42, Radio Receiver with three stages of amplification, No. 43, Four Tube Radio Receiver. Send 25c for each blueprint that you wish to **Popular Science Monthly, 242 Fourth Avenue, New York, N. Y.**

## BOATS AND LAUNCHES

**HUBBELL** Marine Coolers convert Ford engines into marine motors. Ford dope free to boat owners. **C. C. Hubbell, East Ave., Norwalk, Conn.**

## BOOKS AND PERIODICALS

**BOOKS:** Fiction, Humorous, Popular, Educational, Instructive—all good reading. Catalogue 10c featuring over 500 Books. **Valpo Co., 10721, 120th St., Richmond Hill, New York.**

"**LEAST KNOWN AMERICA**"—the year's delightful travel book: maps, illustrations, 286 pages. An autographed copy at regular price, \$2.50, from author—**A. Eugene Bartlett, 77 Fairgrove Ave., Pontiac, Mich.**

## BRANCH OFFICE SERVICE

**WASHINGTON** mail address \$5 month. Established 1920. Address "Service", 605 District National Bank Building, Washington, D. C.

**MR. ADVERTISER:** Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

**Rate 30 Cents a Word. A 10% discount is allowed on all contracts for six consecutive insertions. Advertisements intended for the Feb. 1926 issue should be received by Dec. 5th**

## BUSINESS OPPORTUNITIES

**100,000 REPRESENTATIVES** wanted! Sell by mail, thru Agents, or direct! Detailed information—25c. None free. **Surety Service, World Distributors, Desk B, 551 Harvard St., Rochester, N. Y.**

**PATENTS** procured; Trade Marks Registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. **Richard B. Owen, 44 Owen Bldg., Washington, D. C., or 41-Z Park Row, New York.**

**LEARN** Furcraft—Big Profits waiting in every community. Easily learned at home in your spare time. Get into a high-grade business for yourself. Uncrowded field. No peddling or soliciting. We teach you how. Be first. Write today for free book and full particulars. Enclose 2c stamps, mailing cost. No obligation. **Northwestern Fur Co., Suite 9788, Sunderland Building, Omaha, Neb.**

**BUSINESS** Guide with free legal service sells everywhere. Wells cleared \$1,185 in 35 days. Write for free outfit. **Nichols Co., Naperville, Ill., Dept. 1B.**

**BATTERY** shop equipment and supplies at wholesale. **Adams-Barrs, Columbus, Ohio.**

A new mail order book tells exactly how to start, grow and win. Latest methods explained, new ideas and pointers. Free circular tells all about it. **MacRae, Publisher, 8058 Oregonian Bldg., Portland, Oregon.**

**AGENTS** sell Nushine Silver and Gold Cleaner. A product of superior merit. Sells big in hardware, house furnishing, jewelry and drug stores. Sample free. **Borchard Products Co., 1209 Tribune Building, New York, N. Y.**

**MAKE** Money! 150 Plans FREE! **Wolverine Bureau, (C-1), Muskegon, Michigan.**

**SUCCEED** With Your Own Products—make them yourself. Formulas, Processes by experts. Trade-Secrets. Modern master methods. Catalog free. **C. Thaxly Co., Washington, D. C.**

**USED** correspondence school courses. All kinds. Sold on re-purchase basis. Big saving. Money back guarantee. Lists free. (Courses bought.) **Lee Mountain, Pisgah, Alabama.**

**MIRRORS** re-silvered at home. Costs less than 5 cents per square foot; you charge 75 cents. Immense profits, plating auto parts, reflectors, tableware, stoves. Refinishing metal ware, etc. Outfits furnished. Write for information. **Sprinkle, Plater 94, Marion, Indiana.**

**LEARN** the collection business. Good income; quick results. Interesting booklet, "Skillful Collecting," free. **National Collector's Association, Science Building, Newark, Ohio.**

**BECOME** a Foot Correctionist. A New Profession not medical nor chiropody. All the trade you can attend to; many are making \$3000 to \$10,000 yearly, easy terms for training by mail, no further capital needed or goods to buy, no agency or soliciting. Address **Stephenson Laboratory, 10 Back Bay, Boston, Mass.**

**WE** start you in business, furnishing everything; men and women, \$80.00 to \$100.00 weekly operating our "New System Specialty Candy Factories" anywhere. Opportunity lifetime; booklet free. **W. Hillyer Ragdale, Drawer 19, East Orange, N. J.**

**GOLD, Silver, and colored Sign Letters** for windows automobiles, trucks. Make them yourself with our Process and Letter Patterns. Fast sellers. Big profits. No experience. Stamp brings actual sample. **Walterding, 1144 Pleasant Street, Oak Park, Illinois.**

**STOP** plodding! Be successful. Operate a tire repair shop. Make big profits in any locality. We teach you and furnish complete equipments, \$100 up. Book of Opportunity free. **Haywood's, 1306 South Oakley Avenue, Chicago.**

**START** small home Mail Order Business. Booklet 2c. **Harvey Teeple, Decatur, Indiana.**

**MR. ADVERTISER:** Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

**MANUFACTURE** Dry Chemical Fire Extinguisher, big profits, demonstration makes sure sale. Formula \$1.00. **OGA Co., 3 Ocean Way, Long Beach, Cal.**

**PATENTS** commercialized, D. C. S. Auto Products Co., Indianapolis, Indiana.

**RESPONSIBLE** manufacturer wants competent men to manage office and salesmen. \$300 to \$1500 necessary; will allow expenses to Trenton if you qualify. Address **Manager, 536 Forst Richey Bldg., Trenton, N. J.**

**LEARN** Auto Painting. Complete Course. Thorough and Reliable. Will include 53 successful Plans of Acquiring Wealth. All for \$2.00, or send 10 cents, Descriptive Circulars. **W. C. Jennings, 701 N. W. Bldg., Minneapolis, Minn.**

**MANUFACTURE** new, fast selling novelties, toys, preparations, mail order, agents goods. Free list reliable, plans, patterns, processes, commercial information. **Manufacturers' Bureau, 3937C Tracy, Kansas City, Mo.**

**MAKE** \$100 weekly in agreeable business of your own. Everything furnished. Particulars free. **W. Abell, 141-The-Arcade-Cleveland, Ohio.**

A DIFFERENT business, worth remunerative. Learn privilege trading, small capital. **Dept. R, Paul Kaye, 149 Broadway, New York.**

\$50 a week. Mail Order business. Booklet tells how. Sample and plan 25c. Outfit furnished you FREE. **Bradford Co., Dent, P. Shawnee, Okla.**

**ARE** you old at forty? See our advertisement on page 164 of this issue. **The Electro Thermal Company, 4052 Main Street, Steubenville, Ohio.**

## BUSINESS SERVICES

**CHARTERS**—Delaware; best, cheapest; granted day received; free forms. **Colonial Charter Co., Wilmington, Del. (99)**

**MR. ADVERTISER:** Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

## CHALK TALKS

**LAUGH** producing program, \$1.00. Circulars free. **Cartoonist Balda, Oshkosh, Wisconsin.**

## DISTRICT MANAGERS AND REPRESENTATIVES WANTED

**DISTRICT** representatives. Marvelous opportunity selling Radiolite system of charging batteries to battery stations, garages, auto and radio owners. Wonderful discovery. Free sample. Exclusive territory going rapidly. **Radiolite Co., St. Paul, Minn.**

**WORLD'S** fastest selling auto accessory! County distributors wanted; write to-day. **G. L. W., Spring Oiler Co., San Diego, California.**

## DOGS

**BEAUTIFUL** registered bull pups cheap. Bulldogs, 501 Rockwood, Dallas, Texas.

**TWO** coon hounds five years old, seventy-five each, hundred and forty gets the two, guaranteed anywhere. **Robert Stephens, Jack, Ark.**

## EDUCATION AND INSTRUCTION

**CORRESPONDENCE** Courses. All Schools. Low... prices. Terms. Catalog Free. Mention Subject. **Economy Educator, 440-B Sansome, San Francisco.**

**USED** correspondence school courses save over half. Bargain catalogue 1000 courses free. Used courses bought. Students' Exchange, Dept. A, 47 West 42d Street, New York.

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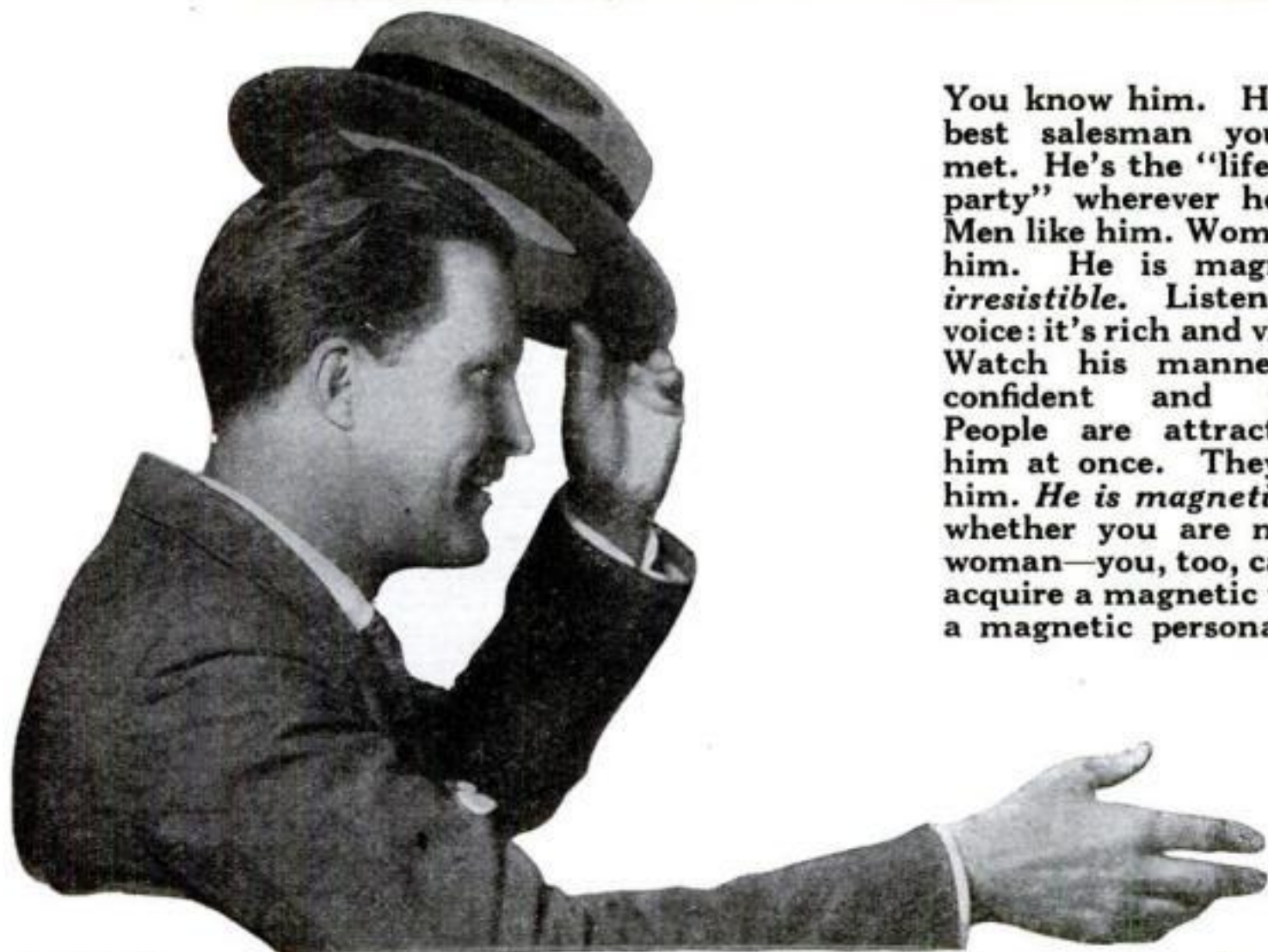
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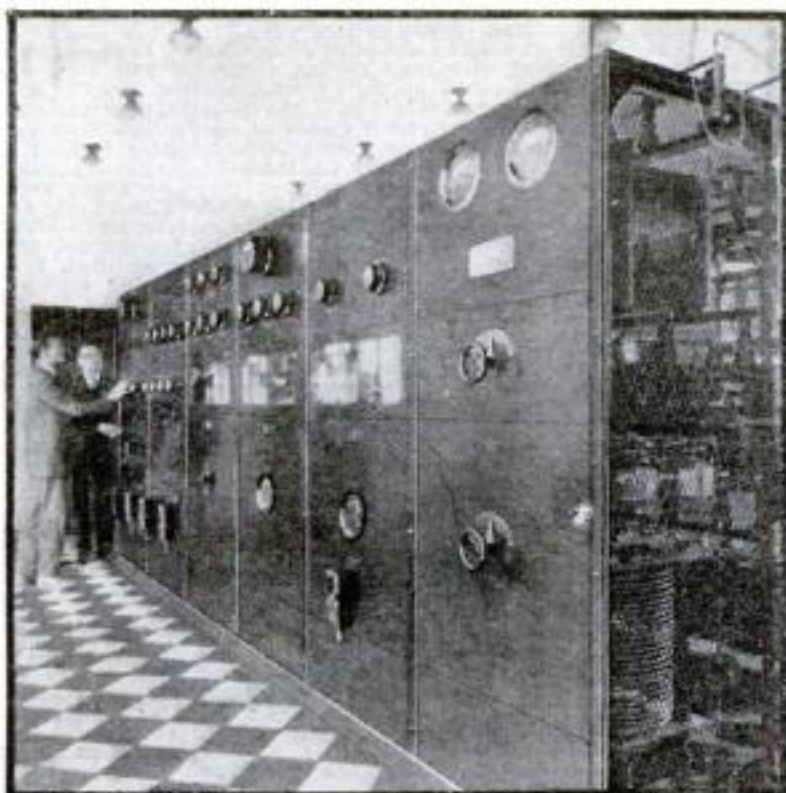
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**SELL** every merchant our special line of Embossed Christmas Display Cards in appropriate Christmas colors and wordings. Ready for immediate delivery. Write today for new catalogue of 100 different signs. Artistic Sign Works, 799 Broadway, New York.

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**SELL** shirts and overalls direct to wearer. Big profits. Work full or spare time. No experience required. Big variety dress shirts with splendid line Union-made work and flannel shirts, overalls, coveralls, work pants, leather and sheep lined coats. Write to-day for free selling outfit. The Nimrod Shirt Co., Dept. 25, 4922 Lincoln Avenue, Chicago.

**SELL** widely advertised Skat paste soaps, toilet soaps, cleansers, polishers, etc. New allowance and commission plan insures success. Skat Company, Hartford, Conn.

**65c. PROFIT** every dollar! Minute demonstration makes sale. Homes, stores, offices, factories, etc. Big repeater. Free sample offer. Mallard Chem. Co., B, St. Louis, Mo.

**AGENTS.** \$60 = \$200 a week. Genuine gold letters for store windows easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 434-A, N. Clark, Chicago.

**GET** our plan for monogramming automobiles, trucks, hand luggage and all similar articles by transfer method, experience unnecessary; exceptional profits. Motorists' Accessories Company, Mansfield, Ohio.

**POLMET POLISHING CLOTH** cleans all metals. Sells fast at 25c. Sample free. F. C. Gale, 15 Edinboro St., Boston.

**MR. ADVERTISER:** Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

**\$10 DAILY** silvering mirrors, plating and refinishing lamps, reflectors, autos, beds, chandeliers by new method. Outfits furnished. Write Gunmetal Co., Ave. F, Decatur, Illinois.

**AGENTS—Best** seller; Jem Rubber Repair for tires and tubes; supersedes vulcanization at a saving of over 800 per cent; put it on cold, it vulcanizes itself in two minutes, and is guaranteed to last the life of the tire or tube; sells to every auto owner and accessory dealer. For particulars how to make big money and free sample, address Amazon Rubber Co., 504 Amazon Building, Philadelphia, Pennsylvania.

**AGENTS—Make** a dollar an hour. Sell Mendets, a patent patch for instantly mending leaks in all utensils. Sample package free. Collette Mfg. Co., Dept. 467, Amsterdam, N. Y.

**EARN \$10** daily silvering mirrors, plating and refinishing metal ware, headlights, chandeliers, bedsteads. Outfits furnished. F. Deele Laboratories, 1133 Broadway, New York.

**AGENTS—Write** for free samples. Sell Madison "Better-Made" Shirts for large Manufacturer direct to wearer. No capital or experience required. Many earn \$100 weekly and bonus. Madison Mfgs., 566 Broadway, New York.

**WE** start you without a dollar. Soaps, extracts, perfumes, toilet goods. Experience unnecessary. Carnation Co., Dept. 21, St. Louis.

**AGENTS—Clever** invention! Inkspoon makes every pen a fountain pen. Fast office seller, big profit, demand increasing everywhere. Exclusive territory offered Sample free. H. Marui Company, Tribune Building, New York.

**INSTANT** Weld—Repairs large punctures without cement or heat. Lenn's profit one day \$56. Write quick. Free sample. Territory going fast. Tourist's Pride Mfg. Co., Desk R, Minneapolis, Minnesota.

**BIG** money and fast sales. Every owner buys gold initials for his auto. You charge \$1.50; make \$1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 47, East Orange, New Jersey.

**AGENTS, both** sexes, we manufacture and control new household article. Fast seller. Big profits. Exclusive territory. Write now. Connolly, 123 Liberty St., New York.

**AGENTS:** Sensational Summer Seller. Just out, \$100 a week possible. World Signs, N 166-W Washington, Chicago.

**WE** pay \$48 a week, furnish auto and expenses to introduce our Soap and Washing Powder. Buss-Beach Company, Dept. A48, Chippewa Falls, Wis.

**GET** our free sample case toilet articles, perfumes and specialties. Wonderfully profitable. La Derma Co., Dept. F, St. Louis, Missouri.

**AGENTS:** Big profits. Best and cheapest window letters made. Easily applied. Dime brings five samples. Particulars free. Staibrite Company, 1115 Second Avenue, New York.

**ONLY** one sale a day means \$200 per month! Marvelous new adding machine. Retails \$15.00. Work equals \$350 machine. Adds, subtracts, multiplies, divides, automatically. Computes feet and inches. Speedy, accurate, durable, handsome. Five year guarantee. Offices, stores, factories, garages, lumbermen buy one to dozen. A fortune for five agents. Write quick for protected territory and free trial. Lightning Calculator Co., Dept. P, Grand Rapids, Michigan.

**WONDERFUL** invention eliminates needles for phonographs. Preserves records. Abolishes scratching. Day's supply in pocket. \$20 daily. Sample on approval if requested. Everplay, Desk 8-12, McClurg Bldg., Chicago.

## SALESMEN AND AGENTS

**100,000 REPRESENTATIVES** wanted! Sell by mail, thru Agents, or direct! Detailed Information—25c. None free. Surety Service. World Distributors, Desk B, 551 Harvard St., Rochester, N. Y.

**10,000** selected manufacturing formulas. Money makers. Southern Trading Co., 53, Flushing, N. Y.

**AGENTS—Steady** income. Large manufacturer of handkerchiefs and dress goods, etc., wishes representative in each locality. Factory to consumer. Big profits, honest goods. Credit given. Send for particulars. Freeport Mfg. Co., 24 Main St., Brooklyn, N. Y.

**SUCCEED** With Your Own Products—make them your self. Formulas, processes by experts. Trade secrets. Modern master methods. Catalog free. C. Thaxly Co., Washington, D. C.

**AUTOMOTIVE** specialty salesmen. Year round steady profits. Adams-Barra, Columbus, Ohio.

**SELL** books and formulas by mail; money making circulars at one-fourth cost. Big profits. Particulars free. Elfeo, 523 So. Dearborn, Chicago.

**SELL** high grade stationery. Particulars free. W. F. Messenger, Dept. P., Stillwater, N. Y.

**TAKE** orders for coffee, sugar, flour, meats, canned goods, staple groceries, also paints, radio sets, tires, auto and tractor oils. No capital or bond required. We deliver and collect. Permanent business. Big pay. Write at once. Hitchcock-Hill Co., Dept. 81, Chicago.

**CAN** you sell Ford size tires at \$3.50 each? Write for plan. Details free. American Accessories Co., Dept. 179, Cincinnati, Ohio.

**WORLD'S** Largest Neckwear Manufacturer wants Salesmen Sell Direct. Remarkable opportunity. Commission 32½%. Complete line. Greatest Values. Write Beacon, 1039 Beaconwear Bldg., Boston, Mass.

**\$31.00 PROFIT—WITH \$1.50 OUTFIT** Big money—easy work. Selling gold monograms for automobiles, luggage, windows, wagons. No Experience. No license. "Sample free." NuLife Monograms, Hartford, Conn.

**BANKRUPT** and Rummage Sales. Make \$50.00 daily. We start you, furnishing everything. Distributors Dept. 34, 609 Division, Chicago.

**\$20 DAILY** selling "World's Greatest foot-comfort Shoes" direct to men everywhere. National demand. Low priced. Long service. Just take orders, we mail shoes direct. Big cash profits. Steady repeats. Territory protected. Best season now. Write quick. Easy-Wear Shoe Co., Dept. 233, Indianapolis, Ind.

**A BUSINESS** of your own. Make and sell enlipped glass name and house number plates, checkerboards, signs. Booklet FREE. E. Palmer, Dept. 513, Wooster, Ohio.

**\$10,000 YEARLY.** Manufacturer World's Greatest Envelope Sealer. Sells \$4.50. Tremendous Demand! Big Repeats. Write quick for exclusive territory. Red-E, 2036 Nottingham Bldg., Boston.

**SELLS** for \$9.75. Prints ad on wrapping paper, envelopes, etc. \$4.00 commission. Send 10c for sample work. Automatic Ad-Stamp, Joplin, Mo.

**AGENTS** wanted to advertise our goods and distribute to consumer; 90c an hour; write for samples. American Products Co., 4198, American Bldg., Cincinnati, Ohio

**LIGHTNING** Electrolyte. Charges storage batteries instantly. Guaranteed not to injure battery. Gallon costs 50c, sells \$10.00. Chance to clean up fortune selling to garages and agents. Make it yourself. Guaranteed formula \$5.00. Write for free circulars. Murphy, Chemist, Tujunga, Calif., Box-K.

**New** beautiful guaranteed \$1.00 pearl necklace—sells on sight for \$5.50. Your profit \$4.50. Order sample now. No experience necessary. Marie Antoinette Perle Company, 500 Fifth Ave., New York.

**AGENTS.** New Selling Plan! \$1.25 premium free to every customer on a \$2.00 sale, consisting of 8-oz. Vanilla, 6-oz. Shampoo, 4-oz. Lemon Lotion. A big hit everywhere. Complete details free. Territory going fast. Write today. The C. I. Tostad Company, Dept. 19P, 29 South Clinton St., Chicago, Ill.

**MR. ADVERTISER:** Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

**NO** dull times selling food. People must eat. Federal distributors make big money; \$3,000 yearly and up. No capital or experience needed; guaranteed sales; unsold goods may be returned. We furnish you with license. Your \$20.00 starting order sent on trust. FREE SAMPLES to customers. Repeat orders sure. Exclusive territory. Ask now! Federal Pure Food Co., L-2311 Archer, Chicago.

**WHY** work for others? Make and sell your own goods. We show you how. Free book explains everything. National Scientific Laboratories, 1900-A Broad, Richmond, Va.

**AT** last! Diamond Rival discovered! Amazing blue white Rajah Gem astounds jewelry world and deceives experts! Beautiful sample case free! \$100 weekly! Write quick! Rajah Diamond Co., Dept. F-10, Salisbury, N. C.

**AGENTS** Wanted—Something new—Fyr-Fyter sells easily. Makes a spectacular demonstration; car owners, homes, factories, stores, practically buy on sight. Our men make \$10 to \$50 a day. Exclusive territory to producers. If you wish to establish a business of your own with unlimited possibilities for making big money, write us today. Fyr-Fyter Co., 901 Fyr-Fyter Bldg., Dayton, O.

**WANTED—Representatives** in every factory in the United States. Popular Science Monthly, 250 Fourth Ave. New York.

**GENERAL** Distributors, Agents, Salesmen, wanted for quick-selling automobile specialty; can average \$75.00 to \$100.00 weekly selling direct to the trade, thru sub-agents; lifetime opportunity for men looking for A-1 sales proposition; permanent business that yields results right from the start. Free folder explains. Atkinson, Co., Mfgs. Cynthia, Ky.

**SELL** by Mail Order, at home spare time. No capital P. Quaint, 5142 W. 25th St., Cicero, Ill.

**WE** pay \$48 a week, furnish auto and expenses to introduce our Soap and Washing Powder. Buss-Beach Company, Dept. A48, Chippewa Falls, Wis.

**SALESMAN:** If you think in terms of \$6000 the first year write me personally. Strong line for retail stores. Nationally advertised. Established concern has unusual opportunity. Liberal weekly advance to producer. Continental Co., 1922 Euclid Avenue, Cleveland, Ohio, Dept. PS.

## SALESMEN AND AGENTS WANTED

**MANUFACTURE** these World's biggest selling specialties. A few dollars will start you making these in your own home, office or shop. You'll have Agents and Specialty Salesmen Selling these for you everywhere. This you easily do with my Guaranteed Superior Manufacturer's Formula and Plain Illustrated Instructions for Sapolin, Blue Crystal Queen of Soaps; New Way Fabric Mending Fluid; Amazon Self Vulcanizing Rubber Tire Weld Cement; Battery Charging Fluid; Parisian Bobbed Hair Liquid Marcelle; Kings all-color Quick shining Shoe Paste; Cleno-Wonder No Water Hand Paste Soap; Thermoite, Radiator Anti-freeze Crystals; Magic Windshield Cloth; and many other New Unequaled sellers in all lines. Investment small, Quick Returns, Profits Great. State what interests you, enclosing stamp for valuable descriptive literature addressing Miller, Chemist, 1706-Jetton-P, Tampa, Florida.

**AGENTS:** \$11.80 daily cash (send for sworn proof, Introducing New Insured Hosiery. 57 styles, 40 colors guaranteed seven months. No capital or experience required. You simply take orders. We deliver and collect (or you can deliver, suit yourself) Credit given. PAY YOU DAILY, monthly bonus besides. Winter line now ready. We furnish samples. Spare time will do. Maccohee Textile Company, Station 15212, Cincinnati, Ohio.

**AN UNUSUAL** opportunity—Earn \$75.00 weekly and bonus taking orders for Nustile guaranteed Hosiery. Sample outfit furnished. Full or spare time. Write now. The Nustile Company, Dept. 4-12, Philadelphia, Pa.

**AGENTS** wanted. Agents—\$100 weekly for your spare time. Radio is calling you. The biggest season in history is about to open. Let us show you how to make \$80 to \$125 per week working all or part time selling our marvelous five-tube radio set on 30 days' free trial direct from factory to user at a saving to your customer of about half, at the same time making a good profit for yourself. We want exclusive agents everywhere. No experience necessary. Write for proposition today. Metro Electric Co., 1243 S. Wabash Ave., Desk 576, Chicago, Ill.

**REAL** Money selling a great new Health Invention generating Violet Ray, Vibration, Electricity and Ozone. Exclusive Territory now open. Write today, Lindstrom & Co., 30 W. Lake St., Dept. 93-69, Chicago.

**AGENTS** make \$100 week placing advertising Cigar. Lighters with glass front. Every dealer wants one. Write for free plan. Drake Mfg., Co., Dept. P., Milwaukee, Wis.

**MR. ADVERTISER:** Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

**MIRRORS** re-silvered at home. Costs less 5 cents per square foot; you charge 75 cents. Immense profits, plating auto parts, reflectors, tableware, stoves. Refinishing metalware, etc. Outfits furnished. Write for information. Sprinkle, Plater 96, Marion, Indiana.

**SELL** Amens Shirts—Over 200 exclusive patterns Made-to-Measure or Ready-Made. Largest commission, 30% collected with order. We deliver, balance collect. Samples Free. Menzin Shirt Company, Dept. 31, 479 East Tremont Avenue, New York.

**IF** you want \$96 a week, a big permanent business, an honest company and an Essex coach without a cent of expense, write now. I need 100 men and women quick to take orders for Jennings hosiery. Don't delay. Send post card now for details. The Frank B. Jennings Co., Dept. L-6, Dayton, Ohio.

**AGENTS** sell Alward's Egyptian Dream Incense for quick sales and big profits. Send for wholesale price list with free sample. Teichert Incense Co., 2402 Bronson Ave., Los Angeles, Calif.

**EARN \$45** to \$85 extra a week, selling beautiful Shirts. Commission in advance. We deliver and collect. Write quick. Fashion Wear Shirts, Dept. 8-361, Cincinnati, Ohio.

**FREE** Booklet describes 52 plans for making \$20.00 to \$100.00 weekly in home or office business of your own. Downs Co., 2326 Myrtle, St. Paul, Minn.

**GREATEST** temper saving device! Takes slack and kinks from telephone and electric iron cords. \$25 daily. Samples on approval if requested. Neverknot, Dept. 129 McClurg Bldg., Chicago.

**AGENTS, Salesmen, Executives** Can Triple Their Sales. Explaining Folder Free. Cutler Company, Reading, Pa.

**LIGHTNING** storage battery compound. Charges discharged batteries instantly. Eliminates old method entirely. Gallon free to agents. Lightning Co., St. Paul, Minn.

**\$50 DAILY** Selling Salesboards—Make up to \$33 on single sale selling largest, lowest priced line; no samples to carry, write for 3-color catalogue and full particulars. Lincoln Sales Co., Dept. K, 9 S. Clinton, Chicago.

**AGENTS:** \$100 a week paid to men who will help me in spare time in local assembly of amazing new kind of 5 tube radio set. I show you how. Demonstrator set given free. No capital needed. Write quick for details of work. Frank Condon, Dept. 11-N, 2632 Prairie Ave. Chicago.

**EARN \$18** daily selling new automobile product. Experience unnecessary. Free folder explains; get it today. Boone Specialty Co., Dept.-Auto, Boone, Iowa.

**SALESMEN** attention. Fast selling Fire Extinguisher, \$2.00 commission on each. Sells for \$3.00 Write Leung-Fox Company, Iron Mountain, Mich.

**50c** brings 3 samples and "Guaranteed To Sell" proposition. Money back if not satisfied. Russell Johnson, Clarkfield, Minn.

**MAKE** \$100 weekly in spare time. Sell what the public wants—long distance radio receiving sets. Two sales weekly pays \$100 profit. No big investment, no canvassing. Sharpe of Colorado made \$955 in one month. Representatives wanted at once. This plan is sweeping the country—write today before your county is gone. Ozarka, Inc., 126 C. Austin Ave., Chicago.

**FREE:** A beautiful 5 tube tuned radio frequency receiver, to the first man in each community who answers this ad within 10 days. Write now for particulars. A nationally advertised loud speaker will be sent free every Monday morning for the first letter opened. E. Parker, Putnam St., Peabody, Mass.

**DUSTLESS** Sponge Cloth, New Invention. (1) Rub—Dusts, Cleans and Polishes Automobiles, Furniture, Planes. Retails 50c.—Costs 16c. Sample Free. Nu Life Sponge, Hartford, Conn.

**WANTED—Representatives** in every factory in the United States. Popular Science Monthly, 250 Fourth Ave., New York.



## \$225 Radio Contest

(Continued from page 59)

sensitive and selective circuit and will give excellent results when used with an outdoor antenna from 50 to 100 feet long. Tuning is accomplished by turning the dial on the shaft of the variable condenser D. Regeneration is controlled by a dial or knob in the shaft that rotates the tickler coil. Powerful local stations can be received on the loudspeaker with the plug inserted in jack P, and for greater volume or the reception of more distant stations, it should be inserted in jack Q.

Be careful of your filament wiring. A radio storage battery delivers current at only six volts, but it is capable of delivering a whole lot of current at that voltage, so if you get a short circuit, some of the wiring in the receiver probably will be burned out.

If, after studying the conditions of the contest, the wiring diagrams in Figs. 1 and 2, and the details discussed in this article, you still have questions you would like to ask before beginning the construction of the set you plan to enter in the contest, remember that the Radio Editor will be glad to help you out with advice or information, provided you do not ask questions as to the best arrangement for the instruments or any other question that the rules of the contest require you answer for yourself.

### The Rules of the Contest

**T**HIS contest is open to every one. Each entrant must build a complete radio receiver mounted in a cabinet, using the wiring diagrams shown in Figs. 1 and 2 on page 59 of this issue of POPULAR SCIENCE MONTHLY. No variations will be permitted except as to the number of rheostats, number of binding posts, and the location of the C battery. The apparatus used may be of any make, commercial or home built, but the parts in the receiver must conform to the list on page 58.

Each entrant must submit two photographs of the radio receiver, together with a brief, detailed description of the receiver written by hand or on the typewriter.

The officials of the Popular Science Institute of Standards will be the judges of the contest. Their decision will be final, and in case of a tie, duplicate prizes will be awarded to each of the contestants.

Contestants need not be subscribers to POPULAR SCIENCE MONTHLY, nor is it necessary to buy this copy of the magazine. You are permitted to consult any copy of this issue available in the public library, or to copy the wiring diagram and instructions from an issue owned by some friend.

The contest closes January 15, 1926. All entries received on or before that date will be forwarded to the judges for consideration.

All contestants must be prepared to ship their receivers to the judges for actual test. The expense of transportation both ways will be paid by POPULAR SCIENCE MONTHLY. No receivers are to be sent except by written order of the judges.

# These books will help you get a better job



Every one of the books listed below was written by an expert. They bring you the results of years of practical experience. They are, in every respect, the best and most helpful books of their kind ever written and are used by leading colleges, including Harvard, Yale, Cornell, Dartmouth, Purdue, Georgia School of Technology, Leland Stanford, etc. They contain much material that is not available in any other form.

**Order them for yourself—Buy them for Christmas gifts**

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- 5—**Foundry Work.** 568 pages—222 illustrations - - - - - \$4.00

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- 9—**Sheet Metal Pattern Drafting.** 294 pages—209 illustrations - - \$4.00
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Mail check, money order or stamps with coupon

INTERNATIONAL TEXTBOOK COMPANY, Box 7672-D, Scranton, Penna.

I am enclosing ☐ check, ☐ money order, ☐ stamps, for which please send me the following books.....

(Write the numbers above)

It is understood that if I am not satisfied with these books, I may return them in five days and you will refund my money.

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Do you want money? Do you want independence? Do you want a sure trade that pays \$50 a week up? Do you want to travel and see the world? How would you like a good driving job? Or a place in a repair shop? Or your own service or tire or battery station?

If you are willing to work for a few weeks you can absolutely promise yourself to make your dream come true. You don't need experience; you don't need education. The Famous Sweeney System of Practical Instruction is taught only at the Sweeney School, Kansas City, Mo.



### Big Special Offer!

#### Jobs Open

Demonstrator, \$150 to \$500  
Garage, \$150 to \$400  
Tractor, \$10 a day  
Electrician, \$225  
Mechanic, \$8 to \$10 a day  
Chauffeurs, \$90 to \$150  
Truck Drivers, \$125  
Tire, \$100 to \$200  
Welder, \$140 to \$200  
Battery, \$150 to \$200

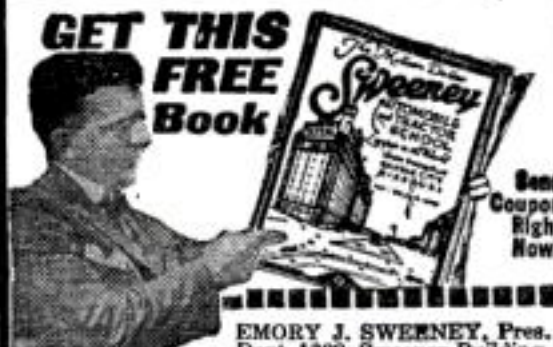
If You're Mechanically Inclined here is your opportunity. There is a fine job ready for you. I refer you to over 60,000 Sweeney-trained men from farms and small towns who have made good. 17 million automobiles in U. S. In my million dollar auto school I train you for high paid jobs in a few weeks. Remember, my amazing offer right now means a lot to you—but you must act quick.

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Simply send name today or clip coupon for my 64-page illustrated catalog. Tells in interesting way about opportunities in auto business and shows how we train men by actual experience, working with their hands instead of learning from books. Come and look at the world's biggest and most popular trade school. See how the men like the World Famous Sweeney System. Get the facts about how easy it is now to make big money doing work you like. Be independent. Travel. See the world. Own your own garage, tire shop, battery station. Take the first step now by sending for this big free book. Special Radio Course free to all who enroll in the next sixty days. No colored students accepted. Remember, this is the most amazing offer I have ever made in the history of this school.

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ST-TUT-T-T-TERING and stammering cured at home. Instructive booklet free. Walter McDonnell, 59 Arcade, 1126 Granville Avenue, Chicago, Ill.

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50 FRENCH Colonials, 30 British Colonials, 20 Portuguese Colonials, 30 South and Central America, all different; price-lists, etc., all only 25c. to introduce approvals. Pennell Stamp Co., Dept. C, St. Louis, Mo.

1,000 United States and Foreign Postage Stamps for Stamp Collectors. 25 Cents. C. W. Parker, 77 Kensington Heights, Meriden, Conn.

FREE! 5 Airmail, 20 unused to Approval Applicants sending 5c. Buckley, 528-P Alameda, Dayton, Ohio.

100 DIFFERENT stamps free to popular approval applicants; postage 2c. Christensen, 124 Second Street, Milwaukee, Wisconsin.

STAMPS, 100. All different, 3 cents. Lists free P. S. Quaker Stamp Co., Toledo, Ohio.

1,000 DIFFERENT stamps \$1.00. Fred Onken, 630 79th Street, Brooklyn, N. Y.

OLD Coins. Large Spring Selling catalogue of coins for sale free. Catalogue quoting prices paid for coins, ten cents. William Henslein, 101B Tremont Street, Boston, Mass.

CALIFORNIA gold \$1/2 size, 27c.; \$1/4 size, 53c. White cent and catalogue, 10c. Norman Schultz, Colorado Springs, Colorado.

STAMPS, 105 China, etc., 2c. Album (500 illustrations) 3c. Bullard, Station AA, Boston.

OLD Foreign Coin sent Free. Cornish Company, Schenectady, N. Y.

UNITED STATES and Foreign money. Medals. Catalogue and Villa Bill, 10c. Alexis Mengelle, Colorado Springs, Colorado.

10 Mozambique 5c to applicants for 50% approvals. Kinman, 634 Union, St. Louis, Mo.

25c buys \$1.00 worth different foreign stamps from our mail. Free Premium. Calculator Corp., Grand Rapids, Mich.

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## Why Small Hats Can Go with Big Minds

(Continued from page 16)

have heavier brains than have short men, short men have brains heavier in proportion to their height than have tall men. But since either tall men or short men may be brilliant, or stupid, this seems to bear out the contention that brain size has little to do with brain power.

It is probable that the wide variation in men's mental powers is caused by varying qualities of brain rather than by differences in the size of brains. The Cornell scientists who examined Mrs. Gardener's brain found it to be not only as large, but as well formed as the brain of Doctor Wilder. Examination of the brain of Anatole France, the French writer who was regarded as an intellectual giant of the present age, showed that his brain was considerably below the average in weight. But, to quote Dr. Louis Guillaume, the distinguished surgeon who conducted the investigation: "It was the most beautiful brain one could dream of seeing. Its convolutions were marvelous. Their curliness was superb. It is a unique specimen."

THESE convolutions that so aroused the scientific enthusiasm of Doctor Guillaume are coils of white matter sheathing bundles of gray nerve fibers. These coils are covered with a soft, fibrous gray material, called the "cortex," which is from one-twelfth to one-eighth of an inch thick, and is the seat of all our feeling and thinking processes. This gray matter is full of little cells, with which the nerve fibers connect. The more pronounced the convolutions, the greater the amount of gray matter; and the more gray matter, the greater the number of cells and nerve connections. The brain is like a telephone central station; and the most recent experiments show that its value should be judged by the number of connections it can make, not by the size of the building that houses it. The brain of a gorilla is about the same size and weight as the brain of a man, but it has fewer convolutions, and therefore less gray matter and fewer nerve connections—and the gorilla stops at being a near-man.

A brain is composed of two perfectly matched hemispheres, each divided into two lobes. The fore-brain is the part that houses the reasoning ability; while in the back-brain are the controls of the muscular impulses. Between the two parts is a connecting link made up of bundles of nerve fibers and acting as a sort of telephone switchboard.

The brain improves in quality with use. New cells form and new nerve fibers sprout. We don't use our brains enough. Sir Arthur Keith, F.R.S., an English anthropologist who has made a study of primitive man in relation to modern man, says that the size of the brain is not increasing, and that probably not the ablest man living to-day uses half of his brain capacity.

The average woman has a smaller brain than has the average man, but she also has a smaller body. Inch for inch and pound for pound, women have as big brains as men.

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## How I Do My Spirit Tricks

(Continued from page 13)

impress the unwary. Thus, a medium whom I exposed a year or so ago established communication with the spirit of a man who had been drowned. This spirit's entrance to the seance chamber was most dramatic.

"Help! Help! I am drowning!" he shrieked. Then came a gurgling, bubbling sound as though the water were closing over the unfortunate spirit's head. A few seconds later: "Help! Help!" came the voice again. "Will no one save me?" And once more we heard the bubbling sound.

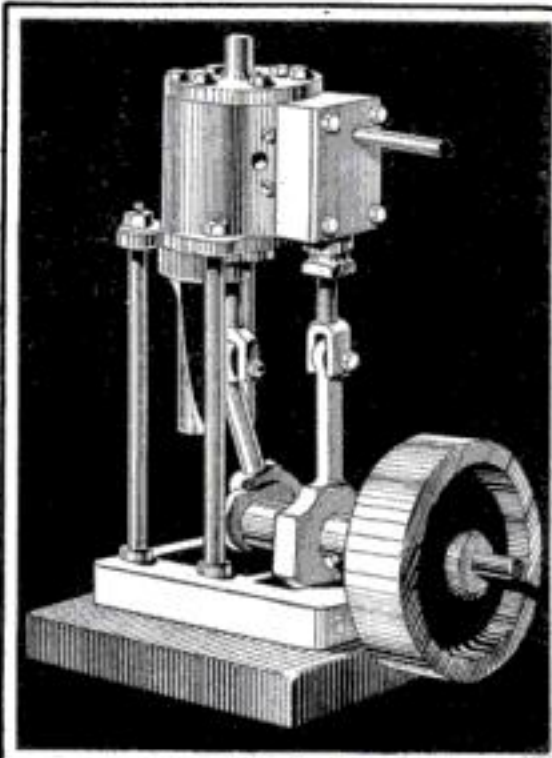
At this juncture I decided that this heart-rending episode had gone about far enough. With a little light on the subject, I thought, we yet might be able to save the drowning spirit. So I arose and directed a pocket flashlight on the medium. There he was with a straw in his mouth, blowing into a shallow bowl of water which had mysteriously appeared on the table since the lights went out!

AT ANOTHER seance only a few months ago, a medium introduced the spirit of Colonel Roosevelt's son, Quentin, who, you will recall, was killed in France while an officer in the Army Air Service during the late war. This spirit came into the seance room in an airplane, and we were not asked to take the medium's word for it either; we could hear the whir of the propeller. Very impressive, I must admit, and undoubtedly most of the people in the room would have been convinced of the genuineness of the demonstration had I not once again used the faithful flashlight. This time the medium was quiet enough, but a confederate was disclosed producing the airplane noises with an electric hair-dryer!

In my youth I attended a seance given by a trumpet medium in a large city of the Middle West. A trumpet medium, you will remember from my last article, is one who uses in his work long cones of tin or other material, resembling old-time foghorns. This medium's trumpets were of tin. They were made in three sections that could be telescoped inside of one another. I expressed a desire to communicate with my father, conveying the idea—without saying so directly—that he had been a farmer in life. As a matter of fact, he was a clergyman and educator; he was still living, and, so far as I know, never had worked on a farm in his life.

FRAUDULENT mediums, however, are nothing if not accommodating, and this one materialized a farmer for me, who spoke with the twang of the stage countryman. Also, many sorts of barnyard noises were produced to add to the rustic atmosphere. A cock crew, hens cackled, a cow moored, and we heard the farmer-spirit pumping water and sawing wood. All of these noises were made with the aid of a trumpet. The animal voices, of course, were produced by the medium, who was a fair mimic. The sawing sound and the sound of pumping were produced by moving the sections of the trumpet up and down inside of one another.

(Continued on page 151)



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## How I Do My Spirit Tricks

(Continued from page 150)

Some time later, after my father had passed away, I made another similar test with another medium, believing that possibly I had done wrong the first time in seeking to communicate with the spirit of a person who was still living. Once again, though, the obliging medium materialized a farmer for me.

Yes, there is no question about fraudulent mediums being accommodating! In New York recently a woman medium let me converse with the spirit of a son I never had. A couple of years ago another medium put me in touch with the spirit of my "first wife," which I will acknowledge was a remarkable feat inasmuch as my first wife—who is also my present and only wife—sat by my side at the time!

ONE class of mediums call themselves "automatic writers." They sit down, take a pencil or pen in their hands, then (so they say) a spirit seizes the writing implement and guides it while the medium writes.

In sketches shown on these pages an artist friend has illustrated for me how a clever medium can make an automatic writer out of a sitter. The sitter holds a pencil in his hand. The medium thrusts both his forefingers toward the sitter's eyes. The sitter naturally enough closes his eyes, and immediately feels a finger on each lid. He assumes that they are the medium's forefingers, but they are not. For at the instant the sitter's eyes closed, the medium dropped one hand, and then used the forefinger and second finger of the other hand to hold the sitter's eyes shut. This, of course, left the medium with one hand free to seize the pencil and make the sitter write anything he pleased.

Lady Doyle, wife of Sir Arthur Conan Doyle, is an automatic writer. Several years ago at Atlantic City, N. J., she gave me a demonstration of her power, writing in my presence a message of 23 pages, which she said came from my sainted mother. Although what she wrote included not a few facts, nevertheless the message was not entirely convincing, for my wife had told Lady Doyle much about my mother and me only the day before. Besides, though the demonstration was made on my mother's birthday—a day which I still regard as a holy day—the message contained no reference to that fact, and it was written in English, a language which my mother never had learned!

SLATE-WRITING, a stand-by of the mediumistic fakers since the early days of spiritualism, is quite different from automatic writing. Here the spirits do all the writing, so the mediums assure us, requiring no aid in holding the chalk. Slate-writing is pure conjuring, and hence adaptable to innumerable ramifications and refinements. I know of more than 200 methods of placing bogus spirit messages on slates and I defy any spiritualist organization in the world to produce a medium who can place a

(Continued on page 152)

# THE DANGER OF NERVE EXHAUSTION

By PAUL von BOECKMANN

The high pressure, mile-a-minute life of to-day, with its mental strain, worry, anxiety, grief and trouble, is **WRECKING THE NERVES** of mankind. This applies especially to the people with highly active brains and sensitive nerves. Have your Nerves stood the strain?

The symptoms of nerve exhaustion vary according to individual characteristics, but the development is usually as follows:

**First Stage:** Lack of energy and endurance; that "tired feeling."

**Second Stage:** Nervousness, restlessness, sleeplessness; irritability, decline in sex force; loss of hair; nervous indigestion, so urstomach; gas in bowels; constipation; irregular heart; high or low blood pressure; poor memory; lack of mental endurance; dizziness; headache; backache; neuritis, rheumatism, and other pains.

**Third Stage:** Serious mental disturbances; fear; undue worry; melancholia; dangerous organic disturbances; suicidal tendencies; and in extreme cases, insanity.

**If only a few of the symptoms mentioned apply to you, especially those indicating mental turmoil, you may be sure your nerves are at fault—that you have exhausted your Nerve Force.**

It is positive your nerves are at fault, if you feel generally depressed, tired and ailing, though repeated medical examinations fail to show definitely some organ is involved. In such cases the decline in organic power is due to subnormal nerve power.

I agree with the noted British authority on the nerves, Arthur T. Schofield, M.D., the author of numerous works on the subject, who states: "It is my belief that the greatest single factor in the maintenance of health is that the nerves be in order."

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Positively no fee is charged for a "Preliminary Diagnosis" of your case, and you will be under no obligation to take my course of instruction, unless you wish to do so. Do not explain your case in your first letter, as I shall send you *special instructions* on how to report your case and how to make certain "nerve tests" used generally by Nerve Specialists. I shall also send you *FREE*, other important data on the subject which will give you an understanding of your nerves you never had before.

I have studied the health problem for more than 30 years from every angle. Far over a million of my various books on Health subjects have been sold all over the world during this time, and as a result about 300,000 people have written me in detail describing their weaknesses and experiences with different methods of treatment they applied. I am more convinced to-day, than ever before in my life, that nerve weakness (*Neurasthenia*), is the basic cause



PAUL von BOECKMANN,

Author of "Nerve Force" and various other books on Health, Psychology, Breathing, Hygiene and kindred subjects, many of which have been translated into foreign languages.

of nearly every ailment of civilized man and woman. Other weaknesses are simply the result of weak nerves. I have learned further, that worry, grief, anxiety, mental strain, and of course, sex abuse, are the basic cause of nerve weakness.

You should read my 64-page book, "NERVE FORCE." The cost of this book is only 25 cents (coin or stamps). The book is not an advertisement of any treatment I may have to offer. This is proved by the fact that large corporations have bought and are buying this book from me by the hundreds and thousands for circulation among their employees—Efficiency. Physicians recommend the book to their patients—Health. Ministers recommend it from the pulpit—Nerve Control, Happiness. Never before has so great a mass of valuable information been presented in so few words. It will enable you to understand your Nerves, your Mind, your Emotions, and your Body for the first time.

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The following extracts are quoted from letters written by people who have read the book:

"I have gained 12 pounds since reading your book, and I feel so energetic. I had about given up hope of ever finding the cause of my low weight."

"I have been treated by a number of nerve specialists, and have traveled from country to country in an endeavor to restore my nerves to normal. Your little book has done more for me than all other methods combined."

"Your book did more for me for indigestion than two courses of dieting."

"My heart is now regular again and my nerves are fine. I thought I had heart trouble, but it was simply a case of abused nerves. I have reread your book at least ten times."

Another writes: "Your book has helped my nerves wonderfully. I am sleeping so well and in the morning I feel so rested."

"The advice given in your book on relaxation and calming of nerves has cleared my brain. Before I was half dizzy all the time."

A physician says: "Your book shows you have scientific and profound knowledge of the nerves and nervous people. I am recommending your book to my patients."

A prominent lawyer in Ansonia, Conn., says "Your book saved me from a nervous collapse, such as I had three years ago. I now sleep soundly and am gaining weight. I can again do a real day's work."

PAUL von BOECKMANN,  
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## How I Do My Spirit Tricks

(Continued from page 151)

single cross on a slate which I will supply and which will not be touched by the medium until after the writing appears. I will describe one or two typical slate-writing tricks which I perform in my stage routine.

The medium engages the sitter in casual conversation as they stand beside a table. Among other things, the medium asks the sitter his name. The sitter, suspecting nothing, gives it, and the conversation continues. Soon the medium requests his caller to be seated. The caller takes the only chair in the room, and the next instant a chair is brought for the medium, and they sit facing one another across a table. The medium hands the sitter a pair of blank slates, and bids him fasten them together with rubber bands. Then he asks the sitter to pass the slates to him across the table. The medium takes the slates and bids the sitter take hold of them under the table. The sitter does so, and, when he removes the rubber bands at the medium's request, finds chalked on the inner side of one of the slates a message containing his own name.

NOW, that is a trick that any one can perform, even without practice. Yet I have mystified people with it in all parts of the United States, and mediums have been mystifying and deluding people with it for years. The trick consists in "switching" slates as they are passed under the table. In other words, the slates that the sitter takes from the medium's hands under the table are not the same pair he passed to the medium across the top.

The medium's assistant had chalked on a duplicate set of slates the message containing the sitter's name as soon as the latter had given it. Then he had clamped the slates to the under side of the medium's chair and carried it into the room. As the slates were passed, the medium slipped the prepared slates out of the clamp with one hand and slipped the other slates into the clamp with the other, these motions being hidden from the sitter by the table.

A simple trick, you'll say; but how effective it is is proved by the fact that by placing the table at the proper angle I can perform it on the stage before a theater full of people, and no one in the audience will know how it is done.

YOU would say, I am sure, that it would be impossible for a medium, a magician, or any one else, to "switch" slates on you when you held one slate tightly in both hands on top of your head. Look at the photograph I have had made for this article, though, and you will see how readily the trick can be performed even by an indifferent conjurer. As the medium reaches up to take the slate from your head, the slate is removed by a confederate hidden by a curtain behind you. At the same time the confederate passes the medium a prepared slate over your head.

You see the medium reach up, you feel

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## U.S. PATENTS



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## How I Do My Spirit Tricks

(Continued from page 152)

the slate leave your hands, you see the medium lower a slate to the table. It will never occur to you, though, that the slate on which you eventually see the message is not the one you were holding on your head. As an experiment once, I performed this trick 25 times in rapid succession on the same person. I told him in advance he was to be tricked, yet until I explained to him the operation of the trick, he had no idea how it was being accomplished.

**T**HE answer is—misdirection, the best tool of the mystifier, whether he be honest magician or fake medium. Get the subject interested in something besides the trick you are doing, then, when he's "looking the other way"—either actually or figuratively—do your trick.

Another effective slate-writing trick, depending on a "switch" and a little simple conjuring, is performed by handing the sitter a playing-card and asking him to drop it into a large book, the pages of which the medium is riffling. The medium closes the book, engages the sitter in conversation for a moment; then opens the book and turns the pages until he finds the card. Note is taken of the number of the page, which we will say is 113, and the first and last words on the page, which we will say are "afterward" and "Bombay."

Eventually the sitter is asked to look at the inner sides of a pair of slates that he previously had fastened together with rubber bands. There he finds, written in chalk, "Page 113," "afterward," "Bombay," and possibly his name and a message from the spirit world.

The explanation of the trick is simple. At page 113 of the book, the medium already has placed a card which matches in value and suit the card which the sitter has in his hand. When the medium presents the book to the sitter, he holds it so that the sitter must place his card between two pages that are approximately as far from the back of the book as page 113 is from the front. When the medium picks up the book from the table after the sitter has inserted his card, he adroitly turns it over, so that his search for the card is in the front of the book, not in the back. Of course, he finds the card at page 113, then he switches the slates so that the sitter will open those already prepared with the page number, the words, and the message. Misdirection again!

**T**HE late Harry Kellar, famous American magician, once gave a remarkable demonstration of slate-writing for a committee of psychic investigators. The seance was held in Kellar's room at a Philadelphia hotel. The members of the committee—the famous Seibert Commission which had \$60,000 to pay as a reward for a physical manifestation of genuine spirit power—had detected many mediums in fraud and were familiar with the tricks of ordinary slate writers. They were prepared to chagrin Kellar, who of course claimed no supernatural powers,

(Continued on page 154)

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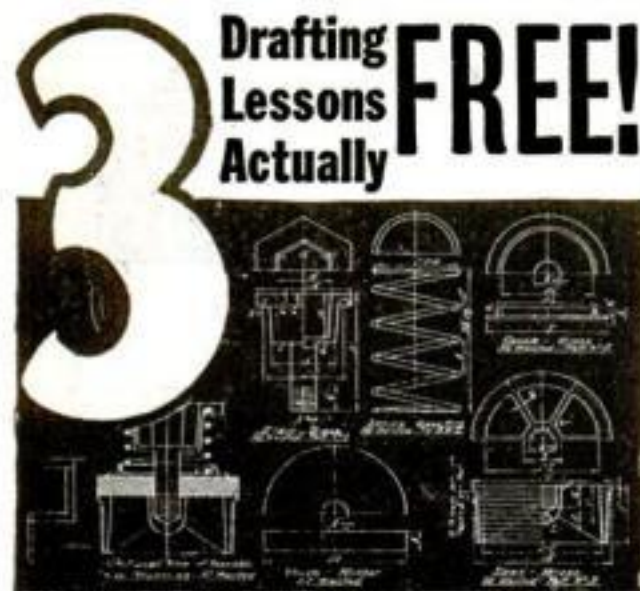
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## How I Do My Spirit Tricks

(Continued from page 153)

by detecting his methods. Kellar, however, fooled them completely.

Although he permitted the investigators to send out and buy their own slates, his demonstration was an entire success, for, previous to the arrival of the committee, he had supplied himself with samples of every kind of slate sold in that section of the city. Then, when the demonstration began, pretending to hold the slates against the under side of the table with his thumb, his other fingers remaining on top, he passed the slates through a trap he had cut in the floor to his assistant who stood on a platform in the room beneath.

THE assistant wrote the "spirit messages" on slates that matched those Kellar passed to him, or, when the members of the committee had marked the slates for identification, on the same slates. The trap in the floor was made to be opened and closed noiselessly and, when closed, was hidden completely by the rug, a portion of which had been cut out neatly with a razor and glued to the top of the trap.

If you ever attend a spiritualistic seance and the medium tells you any facts of a personal sort—things that a stranger is not likely to know—pause long before permitting yourself to be convinced that the information was conveyed to the medium by the spirits. In my previous article I described how I myself obtain information about people in the audience and amaze them by disclosing it from the stage. And you may take my word for it that fraudulent mediums will go to much more trouble to obtain information of that kind than I do, since I gather it merely to entertain.

I knew a medium once who employed a group of canvassers to go from door to door, presumably to sell a household utensil, but actually to obtain knowledge about the families who lived in the city where the medium held forth.

The supposed salesman, once admitted to a home, would pour forth woeful tales of domestic troubles. Housewives of sympathetic natures would listen, then tell some of their own troubles or those of their neighbors, all of which was greedily absorbed by the agents and reported to the medium, who card-indexed the information systematically against the chance that some of the people whose business the agent had learned some day might drop in at a seance. Small wonder that that medium waxed prosperous and gained a reputation for being able to tell people their innermost secrets!

I KNEW another medium who embarked in the real estate business for a similar reason—to obtain information about people who bought or rented property.

I know also a retired circus grafter who has become a successful medium—successful, anyway, in the sense that he is making a large income from his dupes. This man was "broke," "down and out." While looking about for some way to replenish his "bank roll," he chanced to

(Continued on page 155)

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## How I Do My Spirit Tricks

(Continued from page 154)

hear his daughter relate to her mother a spicy bit of gossip she had overheard at a beauty parlor. Immediately an idea flashed into the ex-circus faker's active mind. He borrowed enough money to open a beauty parlor, put his wife and daughter in charge and then set himself up as a medium. And the information obtained by his relatives from their gossiping patrons has made this man rich.

I HAVE encountered several other mediums who have bribed nurses and domestic servants to obtain information for them. I know of at least one case where a dictaphone was installed by a medium in the home of a wealthy family; of at least a half-dozen where mediums have tapped telephone lines.

And you can wager that every bit of astonishing information revealed by a fraudulent medium at a seance has been obtained in some other underhanded way!

Truly system and business efficiency have been installed in the spirit world! Why, there are schools for mediums now, where any one with the price of the course can learn mediumship just as he'd learn swimming—in a dozen lessons. A young woman employed by me in investigating spirit phenomena recently completed the course in a New York spiritualistic seminary and was "ordained," a full-fledged, practising medium. A friend of mine, a California newspaper man, investigating spiritualism, was similarly "ordained" on the Pacific Coast, this despite the fact that he insisted throughout the course that he had no mediumistic power. He did, though, have \$150—the price of the course—so he was graduated with honors.

Just by way of illustrating how helpless a medium is when tested under conditions that preclude all opportunity for trickery, I will tell you of a little incident that happened on my present theatrical tour.

At Pittsburgh, Pa., I repeated the offer I made last month in POPULAR SCIENCE MONTHLY to give \$10,000 to any medium who would produce satisfactory physical phenomena under test conditions laid down by me. A Pittsburgh woman medium offered to answer three questions that I would place before her in sealed envelopes.

We got no further than the first two questions, for the woman's answers were so absurd that she virtually was laughed off the stage of the theater where the demonstration took place.

"WHAT was the name of the first chief of police of Pittsburgh whom I met in Europe?" was my first question.

And the answer she gave was: "All is well, March 30, 1864."

The second question was, "Who taught me the East Indian trick?"

Answer: "Is it possible?"

Which is an expression I am inclined to use myself when I consider the ridiculous hocus-pocus by which fraudulent mediums impress their dupes!



[By WILLIAM R. DURGIN]

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Good machinists work **WHEN WORK IS PLENTY**. Electrical shops have Waiting Lists. I've seen "automotive experts" washing cars! And a beginner in aviation needs make only **ONE** mistake!

\* \* \*

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## He Killed a Leopard with His Bare Hands

(Continued from page 20)

"I did that automatically. The reason I did it was that I had often wondered, when on the trail, what I would do if an elephant ever caught me. And I had planned, as much as one can plan such things, to do what I did then. In other words, I had thought it out beforehand, and now had only to act.

"So there I was, between the great tusks, which he plunged into the ground on both sides of me, with his curled-up trunk against my chest. I have a clear recollection of that instant. I had the sensation of being crushed, and I remember looking up into what seemed to me a very small and wicked eye, just a little way above me, and I knew I could expect no mercy from it. And then he gave a sort of wheezy grunt as he plunged down, and that is all I recall."

IT WAS only sheerest luck that saved Akeley's life. Apparently the elephant's tusks, in burying themselves into the ground, struck something—perhaps a root or a rock—and his enormous weight did not come entirely on the hunter's chest. Quite enough weight came, as it was, for several of Akeley's ribs were broken and forced into his lungs, but he was not suddenly crushed into a wafer, as he would have been if all the animal's great weight had rested on him.

And then, in rising to his feet, after thrusting Akeley to the ground—for the elephant had gone down on his front knees—he drew back and fortunately did not step on his victim. As he had charged, the bull had struck Akeley violently in the face with his trunk. The blow had torn one of Akeley's cheeks half away, exposing his teeth on that side, and the scar he wears on his cheek today is the result. This blow was what had dazed the hunter when the elephant first appeared. But after flattening Akeley on the ground, the great bull did not touch him again. Instead, he busied himself with the natives, who were scampering in every direction through the jungle, dropping bundles, climbing trees, dodging and hiding.

BUT finally the gigantic elephant departed unharmed and, again fortunately, without going back to the unconscious Akeley. Even with the elephant gone, the natives did nothing, except to send a man to the base camp to report that Akeley had been mauled. They believed that *Bwana* Akeley was dead, and they never will touch a dead man.

For four or five hours they allowed him to lie unprotected in the cold drizzle, while they huddled about a fire they had built. At last Akeley came to, and vaguely saw the fire. He called, very weakly, and the natives, seeing that he was not dead after all, hurriedly erected his tent, and took what care of him they could.

At first Akeley thought that his back was broken, for his limbs seemed paralyzed, but a bottle of cocktails, some beef

(Continued on page 157)



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## He Killed a Leopard with His Bare Hands

(Continued from page 156)

tea, and quinine warmed him up and brought back feeling to his crushed body. With the greatest of difficulty he was carried from the jungle, and after three months in a hospital, he was fit to hunt again.

Akeley could tell you, as he told me, scores of other stories almost as dramatic.

He was caught, one day, in the middle of a herd of 700 elephants in the thick jungle where he could see but a few feet. All day they drove him here and there, but finally he got back to camp safely. He has been charged more than 20 times by rhinos, and on one occasion was sitting unarmed on the ground when three of them made for him. But their eyesight is bad, and all three missed.

"Such a charge," Akeley told me, "was much more pleasing to me, and was apparently just as satisfactory to them as if they had been successful."

HE HAS shot lions and buffaloes, elephants, leopards, hippopotami, rhinos, and scores of other animals. He has hunted gorillas, and has a wonderful group that, within a year or so, will go on exhibition at the American Museum of Natural History. He has spent years in Africa, and is going now to spend another year, to get more specimens for "African Hall," which is the great proposed addition to the American Museum that Akeley has worked on for so many years.

But in all his hunting he never has shot for pleasure. He spent a week getting five specimens from a herd of buffaloes. He could have shot five times that many, but he wanted only five animals—an old bull, a young bull, a cow, a half grown buffalo, and a calf—for he knew that from these a student could learn more than he could from 50 improperly chosen specimens.

THE old Africa of the countless herds and the great mastodons is going fast. Our children never will be able to see the animal paradise that supported its hundreds of thousands of magnificent specimens when Akeley made his first visit to "British East." But when the last of the great herds has disappeared and wild animals in Africa are as scarce as wild buffaloes in America, we can go to African Hall at the American Museum of Natural History, and see there the beautiful and dignified specimens of the great beasts that Carl E. Akeley has risked his life to hunt and study during his adventures in the wilds.

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## Are You Fit to Drive a Car?

(Continued from page 23)

The Washington tests include, however, besides these and a set of physical and eyesight tests, a series of visual tests and a set of test questions. These last can be used conveniently by any one who wishes to apply them to himself.

The visual tests consist of a series of photographs of automobiles in dangerous situations, such as cutting a curve on the wrong side, parked on a curve, stalled on a railroad track, etc., with a space under each picture wherein the subject is to write his statement of "What is wrong with this picture?"

The test questions, 50 of them, give a pretty comprehensive picture of the applicant's theoretical knowledge of driving. The most important of them are reproduced herewith. There is but one correct answer to each question, but four answers are printed, from among which the candidate must make a practically instantaneous selection.

YOU, for example, should know that you are unfit to drive a car if you can't instantly answer the first of these test questions correctly. It reads:

If while driving I heard the gong of a fire-department truck coming down the street behind me, I should:

1. Drive faster in order to keep out of the way.
2. Drive more slowly, so that the truck could soon pass.
3. Drive immediately to the curb and stop.
4. Stop in the street as soon as I heard the gong.

If you are fit to drive, you know that Number Three answer is the right one. Look over the other test answers on page 23 and see how many more of them you can answer correctly, offhand and instantaneously.

"Everybody driving a car ought to be put through a comprehensive psychological test," Doctor Wechsler says. "Eventually every municipality will require something of the sort before a driver is licensed, as Washington now does and Paris has done for some time."

It is not in the heaviest traffic, however, that most motor accidents occur. I interviewed Thomas T. Murphy, the traffic cop at Broadway and Forty-Fifth Street, New York's most congested crossing, where two street-car lines and six lines of motor traffic converge in the middle of Longacre Square to make it one of the city's worst danger spots.

"DO YOU have much trouble here with unfit drivers?" I asked him.

"No. Most of 'em are good drivers—the professional drivers, anyway," he replied. "It's the amateurs and the women that make most of the trouble for us traffic cops—and, of course, the hooch-hounds and the hopheads."

He paused to exchange compliments with a taxi driver who was trying to beat the signal. Out from behind the offending vehicle popped a touring-car, just

(Continued on page 159)

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## Are You Fit to Drive a Car?

(Continued from page 158)

missing the policeman as it plunged ahead at a right angle into the stream of traffic.

I thought, for an instant, that I was about to have an ocular demonstration of the tragic end of an unfit driver. Then, as a long black limousine swerved shriekingly out of the newcomer's path and a dozen cars came to a squealing halt, the officer's whistle seemed to penetrate the consciousness of the man at the touring-car's wheel. He stopped his car in less than its own length and looked at the policeman shamefacedly. He was a dignified-looking man of middle age, with a far-off expression about his eyes.

"Back up!" commanded the traffic cop. "Back up and pull over to the curb till I fix up a summons for you. What were you trying to do—commit suicide?"

"I WAS thinking about something else, officer," said the offender contritely. "I saw the car ahead of me start and didn't notice that the traffic signal had not changed." In response to the policeman's demand to see his driving license, he presented a document bearing the name of one of New York's most famous physicians.

"That's what I was saying just now," resumed the policeman, when the traffic once more was flowing smoothly. "It's the amateurs that are the bum chauffeurs. The boys that drive for a living, taxi men and truck drivers and that kind, know their jobs, and unless they've been hitting the bootleg, they don't often get into a mess.

"Take a boy like that now," he continued, indicating a telegraph messenger on a bicycle, threading his way among the motor traffic in a way that seemed perilous in the extreme. "That kid'll make a good chauffeur. Why? He's been raised to take care of himself in the street. Get what I mean?"

I GOT him. That was what the psychologists had just been telling me—that the real test of a fit driver is his ability to concentrate on the job of driving, which is one of the reasons why professional men and men of affairs, with their minds full of weighty problems, make poorer drivers than those of less general intelligence, usually.

"There aren't many bad accidents around here, though, where everybody's looking for trouble. The place you want to look for the 'unfit' drivers you were talking about is out in the country."

Again the traffic policeman was right, for all the investigations into the causes of motor accidents have come to the same conclusion, that the danger in motoring is greatest where the traffic is lightest. The open road is a temptation to carelessness.

This is the simple test, which you can apply to yourself, to determine whether you are fit to drive a car:

When you are out in the clear, where everything looks safe, do you then let anything divert your attention for an instant from the road ahead.

If you do, you are unfit to drive.

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## The Best Sport for You

(Continued from page 30)

Jumpers are slightly different than track men. High jumpers are inclined to be slim. Broad jumpers, again, are like dash men, except that they have muscles in the backs of their thighs that are so strong and powerful they stick out almost like bustles. Ned Gourdin, the first broad-jumper to break 25 feet, said his record was the result of sprinting; coming to the mark at the rate of 10 seconds for the hundred. All jumpers have what might be termed "grasshopper" legs, where the length from the knee to the hip is noticeably out of proportion to the length from the knee to the ankle.

**WEIGHT** men—the shot-putters, hammer and discus throwers—usually are huskies, built something like football and crew men, with much greater weight through their chests than, say, a jumper. They need strength, resilience, and endurance.

As I said, there are striking exceptions when it comes to the ideal athletic build. Tell Berna, one of the many great distance runners Jack Moakley developed at Cornell, was quite tall and stringy. John Paul Jones, perhaps the greatest of the Cornell distance men, was rather small. Jack Merchant, the Pacific Coast weight man, is a little giant; he is only about 5 feet 5 inches tall and weighs 175 pounds.

Football men and crew men are rather alike in build, according to Barrett. While we were talking, he pointed out Wiberg, Columbia's crew captain and so fine a guard that he upset three Army men at a clip in Columbia's game with West Point last year. Wiberg is big, strong, and straight, particularly powerful from the waist up. He is supple at the waist and the possessor of fine legs.

**JIM THORPE**, the famous Indian, whom Charlie Moran, coach of the celebrated Centre College football team, told me he considered the greatest football player that ever lived, is an ideal football and crew type. Brick Muller of California, Tack Hardwick and Charlie Owen of Harvard, French of the Army, Red Grange of Illinois, the famous Horsemen of Notre Dame, all are of this ideal football and crew build.

Here again, though, there are exceptions. A classic example is Freddie Briggs, first of a long line of famous stroke oars the late Charles E. Courtney brought forth at Cornell. Here was a small man who weighed only about 136. But he was a pocket Hercules with arms like a gorilla. He could pull an oar!

Boxers and wrestlers are of the same general build, but their specialization promptly develops different sets of muscles. A boxer must be lightning fast on his feet, with exceedingly supple muscles in his back and shoulders. A wrestler, on the other hand, needs strength and resilience more than speed. He must have great strength about his neck, his arms, and in his legs—strength that includes endurance. Dempsey, for instance, is straight-waisted, fast, supple; you can see every move his muscles make

(Continued on page 161)



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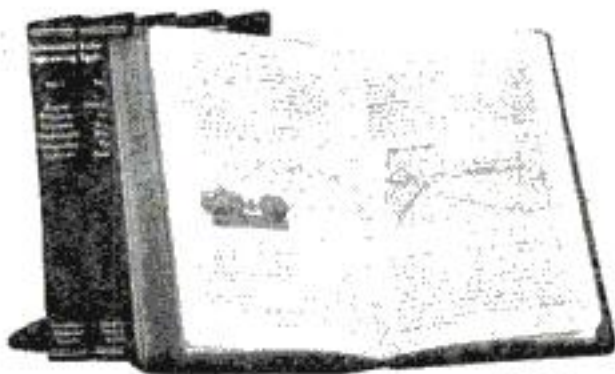
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in front advertising section

## The Best Sport for You

(Continued from page 160)

under his skin. "Strangler" Lewis, the wrestler, on the other hand, is thick-necked and stalwart, exceedingly developed in the arms and back.

A swimmer, again, is different. Take Johnny Weissmuller, for instance. Here is an ideal swimming build. On the whole, he is of the ideal type Doc Barrett describes, but he has developed specifically his back muscles, so that he is broad and strong in the shoulders and tapers through his hips to his legs.

A great polo player has the build Barrett describes for an ideal athlete. Devereux Milburn, the world's greatest polo player, would make a football or a crew man. He is nearly six feet tall, broad and square, with powerful arms and legs. He looks almost too big for his ponies, Tommy Hitchcock is of the same build. Eric Pedley, the California poloist, is of the same type.

ONCE more an exception must be noted. Luis L. Lacey, the remarkable Argentine polo player, is small and slight, something like Little Bill Johnston.

Given an athlete of ideal build, the work of making a star is still not an easy one. Doc Barrett has four cardinal principles and he explains them as follows:

"The first thing to develop is bodily contact. An athlete must never fear an opponent. He must be ready for any shock. Football is perfect for this. It teaches a man courage and stamina and quick-wittedness.

"The second thing to develop is brain activity. Baseball is great for this. Take two teams that are evenly matched, and the one that can out-think the other will win every time. No champion ever was a dub.

"Third, we must develop speed. Basketball is a perfect example of the need for speed and intelligence as well. A single false step in basketball, a single slow move, and you're as completely out of play as though you weren't on the floor.

"FOURTH, teamwork. There's where you can look to crews. The teamwork must be absolutely perfect or there's no crew. You can't carry passengers in a shell, can you? Sacrifice of self is essential to perfect teamwork.

"I'd mention a fifth, but I take that one for granted. It's stamina—the ability to come back for more, never to say die."

Doc Barrett may call it stamina, but there's a scientific explanation for the ability to come back for more, the ability to recover. It was propounded by Professor Hill, of London, in the address before the British Association for the Advancement of Science that I mentioned above.

Professor Hill discovered why some men can perform greater feats of endurance with less fatigue than others. Fatigue, he found, is caused by the generation of lactic acid in the muscles, while recovery from fatigue is brought about by the absorption of oxygen, which reduces the lactic acid by chemical reaction.

(Continued on page 162)

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### The Best Sport for You

(Continued from page 161)

(Lactic acid is similar to the acid of sour milk.) The greater the amount of oxygen a man can take in, the quicker and more complete will be his recovery from muscular fatigue. Thus, panting after violent exercise is due to Nature's effort to supply the necessary oxygen as quickly as possible.

Professor Hill has shown by means of a breathing apparatus that the oxygen needed during exertion can be "borrowed" against the individual's capacity for taking in oxygen after exertion. This he calls "oxygen credit," and on it, he explains, depends an athlete's capacity for violent or continued exertion.

HENCE, if the "oxygen credit" of a group of athletes were to be determined before a contest, the winner might be determined beforehand, were it not for the fact that the factor of muscular economy, the result of skill, must be taken into consideration, since it permits those of smaller oxygen credit to husband their strength and perform the same work as those who have greater oxygen credit.

It is known that Nurmi, the great Finnish runner, has extraordinary endurance. Doctor James J. Walsh, the only American physician privileged to examine Nurmi before and after a race, told me the Flying Finn took in more oxygen than most athletes because he held himself erect when he ran, thus lifting the top of his chest and giving his lungs more chance to inhale. Thus did Nurmi store up oxygen credit.

It is obvious, then, that any youth of sound body can become an athlete for his own good. He may not become a champion, for champions are rare as phoenix birds, but he can at least do himself immeasurable good.

Indeed, I can go further and say a youth can become an athlete and a good one, even if he hasn't a sound body. I am reminded of a boy named Alfred Snedeker, who lost a leg in an accident when he was a child. He became one of the best schoolboy high jumpers in Greater New York, leaping to the up-rights on a wooden crutch and a leg that was like finest steel, casually dropping the crutch as he started his jump. He became an exceptional swimmer, going one day from Staten Island to Coney Island—10 miles or more. He went to Cornell, where he became a very fair wrestler in a university where the wrestlers of the day were intercollegiate champions.

I AM thinking, too, of a frail and hot-tempered little rascal who had to be sent into the fresh air to keep body and soul together. That boy wandered to golf, conquered his sickly limbs and stubborn temper to become the greatest golf champion America has ever known. I refer to Bobby Jones, who last fall won his second amateur championship in as many years, adding further glory to the greatest competitive record in the history of American links.

Such men as these have more than chestnuts up there in their heads and down there in their chests!

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## What Could You Do with \$50—?

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Page 4.

## Winter and Your Car

(Continued from page 64)

was speechless. Gus found him leaning limply against the side of the garage and glaring ferociously at the car.

Gus walked around the car and carefully looked over the motor, poking it here and there like a doctor with a patient. He tentatively pushed the self-starter pedal, and was rewarded by a faint humming sound. He snapped on the lights for a second and they glowed dimly. After that he unscrewed the radiator cap and squinted down the opening.

"YOU sure have got yourself into a pretty pickle this time!" he growled. "Everything is on the blink! Let's see—you came out here and hopped in and stepped on the self-starter. Instead of turning over the motor, the self-starter let out a clank or two, and after that nothing happened. Am I right?"

"As usual!" replied McKay dismally. "What happened?"

"Old Jack Frost has got you, that's all," said Gus. "The whole works is frozen up solid. Radiator full of ice—cylinder jackets frozen and cracked—starter motor shaft sheared off. That happened when you stepped on it the first time. You see the pump is frozen, too, and that and the cold-thickened oil wouldn't let the motor turn over at all. First the pump shaft broke off and then the starter motor shaft let go under the strain. It's funny how easily steel cracks when it's cold. After that, you were able to crank it by hand because you primed it and the gasoline thinned out the oil. The battery is almost exhausted. That will freeze up too if we don't watch out."

"But if you get it started right away, the generator will charge it up in short order," McKay said hopefully.

"You're certainly a hopeful fellow!" grunted Gus. "The only way this car goes out today is on the end of a rope, and there's a rope handy in my toolbox."

"Be careful, now, not to run into me, if I have to stop sudden," he warned, as he started to tow McKay's car toward the Model Garage.

AT THE garage, Gus inspected the car closely; when he turned to McKay with a more cheerful expression on his face. "It's not as bad as I thought," he said. "The crack doesn't go through into the cylinder wall, so I guess we can weld it up. Then, after we get the radiator soldered up, the pump shaft fixed, and the starter motor working again, I guess you can take it home."

"How long will that take?"

"Two days at least," said Gus, "maybe more if we have to wait for a new shaft for the starter motor."

"All right, if that's the best you can do," McKay agreed. "But what I want to know is how to get the motor started after it has been standing in a cold garage all night. I've tried priming and that helps some, but usually the battery is nearly dead before she finally starts."

"Well," Gus began as he reached in the toolkit for another wrench, "there are a

(Continued on page 164)



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## Winter and Your Car

(Continued from page 163)

lot of little things you can do that will help a lot. Setting the spark plug points real close is one of them. That helps, because when the motor is very cold, it takes a lot of juice out of the battery to turn it over. That means there isn't much left to work the spark coil, so if you have the points set too wide, the spark hasn't pep enough to jump the gap. Another way is to use a separate set of dry cells connected so that you can work the ignition from them while the starter motor is working. One set of dry cells will last all winter for this kind of service if you are careful to throw the switch over to the storage-battery current just as soon as the motor starts to turn over under its own power."

"SEEMS to me," remarked McKay, "that there ought to be some way to make the motor turn over easier so that the starter motor would not have so much to do. How about using light oil?"

"There is only one rule to follow on the oil question," Gus stated emphatically. "Stick to the recommendations of the makers of the car. If you will glance over your instruction book again you will see that they tell you what brands to use in winter."

"With dry batteries rigged up and the radiator filled with the proper mixture of water and alcohol, you ought to have no trouble till the thermometer gets down below fifteen degrees. When it gets much colder than that—say about zero—even extra batteries and light oil won't get the motor going, simply because the gasoline we're getting these days doesn't form gas enough to give an explosion."

"A radiator cover will help some, but if you leave the car for hours at a time outdoors in zero weather, everything will get so cold that she won't start, no matter how long you keep the self-starter going. When you're up against that proposition, a good stunt is to pour a teaspoonful or so of ether into the air intake of the manifold. Ether evaporates nearly as well in cold weather as it does in hot, and the motor will start pronto. If you get a pail of boiling hot water and pour it over the intake manifold of the engine, that also will make it start right away."

"There's another new device out now that will start the motor, no matter how cold it is. Hey, Joe!" he called out. "Bring out one of those electric-heater primers the right size for McKay's car."

"SEE here," he continued, holding up what looked like a thick gasket. "This goes in between the manifold and the carburetor. When you press the button, the little spiral wire in the middle gets hot and that heats the gasoline as it comes up from the carburetor and turns it into gas. The electric current comes from the storage battery, of course. Shall I fit one when I bolt the carburetor on again?"

"Sure thing!" exclaimed McKay. "That ought to work out fine. It's a good thing I have a radiator cover, or you'd be trying to sell me one of those too!"

(Continued on page 165)

## Young outdoor men wanted



To a few sturdy young men—lovers of fresh air and sunshine—who want to get away from the grind of indoor work—John Davey's national organization, The Davey Tree Expert Company, offers an exceptional opportunity. Constantly increasing demand will create a limited number of openings. Those young men selected will be thoroughly trained by the Company and given a permanent position if they make good. If you are single, between 20 and 30 years of age, free to travel, healthy, industrious, having a good practical education, and able to furnish satisfactory references, you have a good chance to qualify. Pay is good at start, advancement assured on merit. We want only men who desire permanent employment in a growing organization and will accept only clean, sturdy young men, thorough Americans, not afraid of vigorous outdoor work. Write for additional information and qualification blank to serve in place of personal interview. The Davey Tree Expert Co., Inc., 302 Federal Bldg., Kent, Ohio.

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See—the big Prize Offer on  
page 4 of this issue.



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## Winter and Your Car

(Continued from page 164)

Gus smiled. "After you get the bill for this repair job," he said, "you won't have the price of any fancy accessories."

"One thing I nearly forgot to mention about that cold-weather-starting proposition! Always hold the clutch out when you step on the self starter. That disconnects the transmission gears, and in cold weather, when the transmission oil is thick and gummy, it takes a lot of power just to turn the gears over."

"Of course you want to remember, too, that just getting the motor started is not the whole story in driving a car in cold weather. You can put a car on the bum mighty easy if you don't watch out. In real cold weather the grease in the transmission is likely to freeze solid, and when it is in that condition the gears just cut grooves through it and they run practically without lubrication until the friction heats up the grease and melts it. Hard grease is bad medicine in cold weather. The transmission should be filled with transmission oil instead of grease. The same applies to the rear end."

"Gosh!" McKay exclaimed. "That's a whole lot to try to remember all at one time. Guess I ought to write it down."

"You'd better learn your lesson this time," said Gus. "The next time you freeze this boat up I'll charge you double!"

## Correct Answers in Contest

(Continued from page 26)

fire. B—The gasoline tank of a Ford car is not at the back of the car as shown, but under the driver's seat.

Picture No. 5. A—John is taking Mary's picture while Mary is in the shade and the lens of the camera is pointed directly toward the sun. These positions should be reversed. B—The handle of Mary's parasol is drawn at a wrong angle in relation to the ribs.

Picture No. 6. A—John is nailing down adjacent sides of the netting instead of opposite sides. This will cause the netting to bulge. B—The teeth of the saw hanging at the side of the bench are drawn in reverse so that the saw will cut on the pull instead of the push.

Picture No. 7. A—John is wheeling coal over the lawn in a wheelbarrow without first laying boards to protect the grass. He will ruin his lawn. B—The artist shows water coming out of the hose, although the hose is not connected with the faucet.

Picture No. 8. A—John is building the vegetable bin too near the furnace. The heat will spoil the vegetables. B—The drawing is out of perspective. The broom shows that John's feet are far away from the bin, yet his hands are close enough to nail the board at the top.

**EDITOR'S NOTE.** Our purpose in withholding publication of the correct answers for the June Contest until this issue, instead of publishing them last month, along with the names of the first prize-winners, was to preclude any possibility of unfair competition. While our November issue was in the process of manufacture, the Grand Prize Contest, involving all four Monthly Contests, was still open to entry.

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## Here Are Correct Answers to Questions on Page 47

1. Because the little box in the throat which holds the vocal cords and in which the voice is produced is small, as are also the passages in the throat and nose in which the sound reverberates.
2. Faster. The sled is moved by force of gravity. The heavier the sled, the stronger the force of gravity.
3. This common observation seems never to have been investigated scientifically. The probable reason is that a little air dissolved in water makes it freeze less readily. The cold water has air in it. The water in the hot-water pipes lost its dissolved air when it was heated.
4. They are really a ring-shaped cloud containing a great number of moons, much like our moon, but much smaller.
5. In the wood are a great many small cells. Some of these have a little moisture. When the wood gets hot this moisture turns to steam and bursts the cells. This makes a noise like a small explosion and many such noises make the crackle of the fire.
6. The modern theory is that they connect with small pools or pockets of melted rock not far below the surface. Such pockets may be due to the rock's being a little hotter than usual just in that place or they may be caused by a lessening of the pressure of the rock above. Lower pressure would let the rock melt more easily, just as relieving the pressure in a steam boiler lets the water in it all fly off as steam.
7. It passes a current of electricity through the root of the hair and kills it.
8. Apples contain a small amount of a certain chemical compound which is colorless so long as it is in the apple, but which combines very rapidly with the oxygen of the air as soon as it comes in contact with it. The result of this combination is another compound that happens to be dark brown in color.
9. Yes. Their memories differ from ours only in that they are simpler and are not likely to last so long. The higher animals remember almost as well as we do. Even the lowest animals have some memory. A cockroach, for instance, can remember a path that leads to food, but remembers for only about 20 minutes.
10. The characteristic thing about a radio crystal detector is that it will allow the electrons to pass through it only in one direction. This is true of a vacuum tube. The electrons will pass from the filament to the plate, but not from the plate to the filament. Accordingly a vacuum tube has the same property (in this connection) as a crystal, and can be used equally well as a detector.
11. The needle of the pine tree is really its leaf and this needle contains chlorophyll just as other leaves do. But the surface of this pine needle is tougher than the surface of the ordinary leaf and so the chlorophyll inside it is better protected during the winter. It stays green.
12. Usually the black-eyed ones are not only more excitable, but have higher-strung nervous organizations in other ways. This is a racial characteristic. Black-eyed people are usually of the dark-skinned or Mediterranean branch of the white race. Blue-eyed people are of the light-skinned or Nordic branch.



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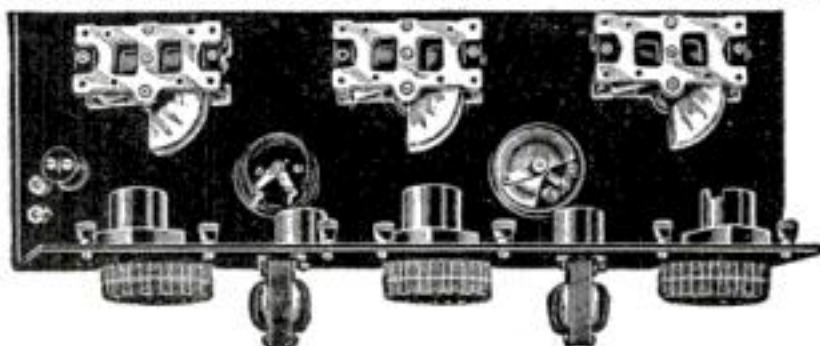
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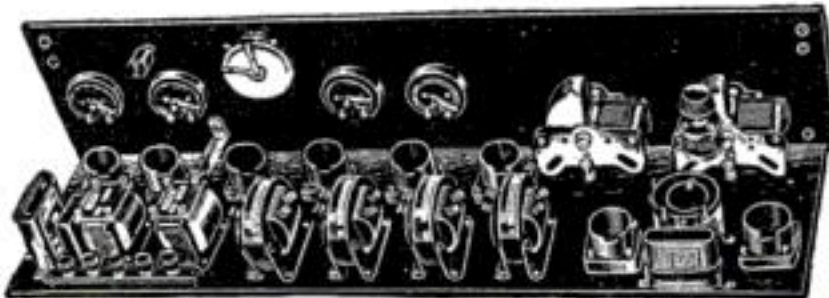


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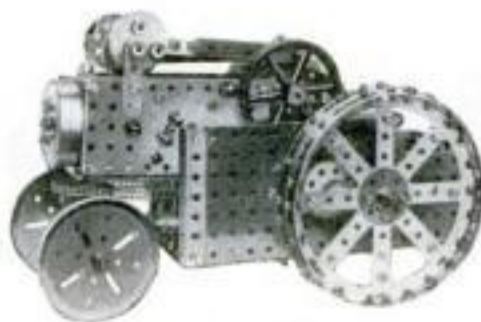
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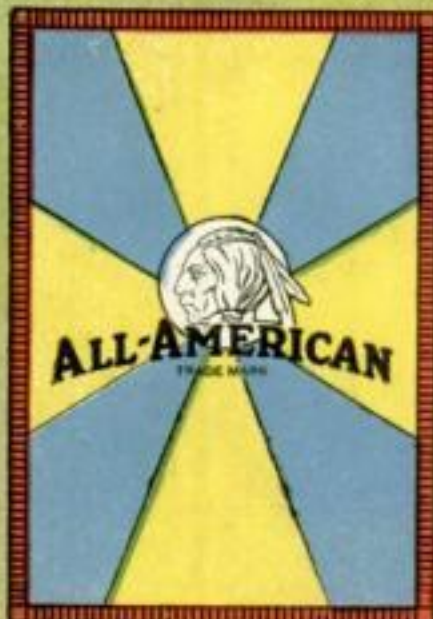


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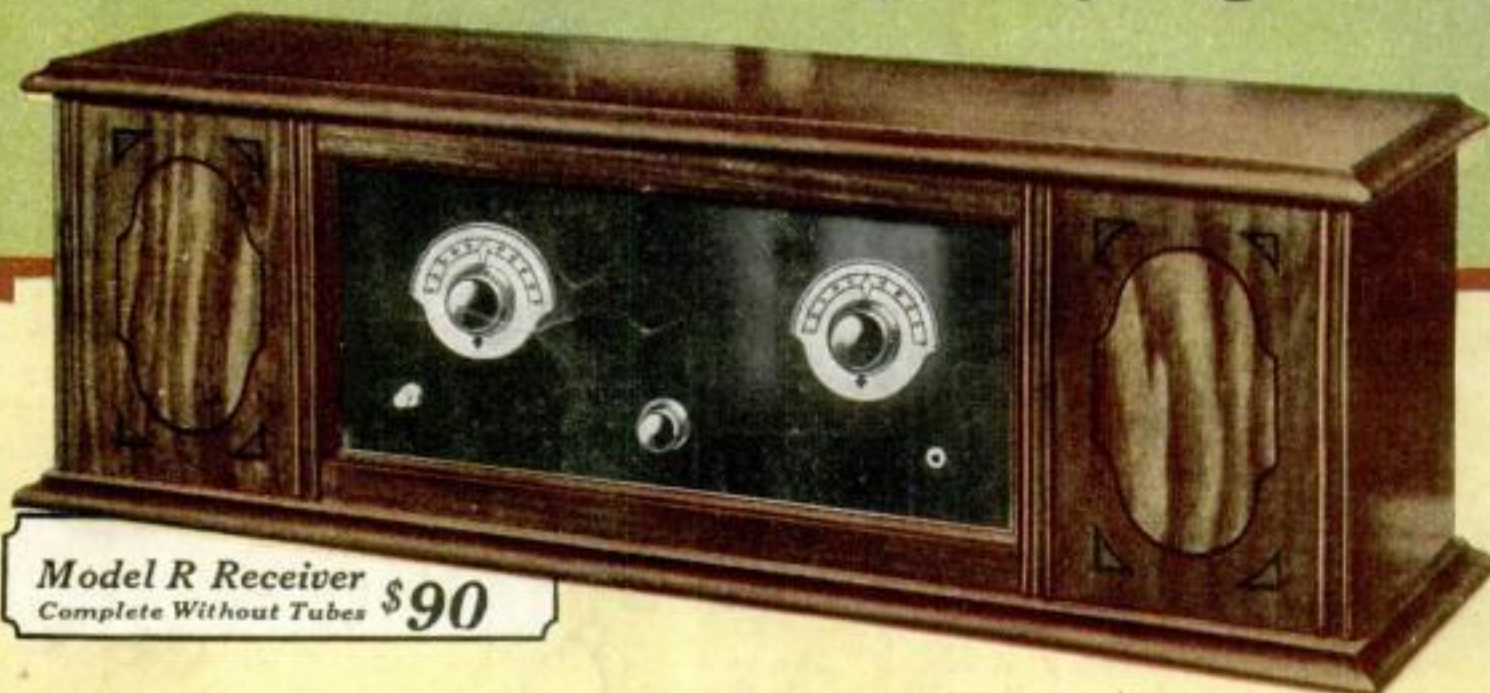


Built and wired complete in the new ALL-AMERICAN factory, the Model R Receiver is offered as an ideal example of the *solid value* which a thoroughly equipped and experienced organization can build into a product.

Compare this receiver with any set you have ever admired or wished to own—disregarding, for the moment, the entire question of price. Compare the *construction*—and check each of the six vital principles of value as briefly outlined below.

Then, apply the final critical test—*compare the performance*. After that—and not until then—remember the price at which the ALL-AMERICAN Model R is offered and ask yourself this question:

## What Can You Get by Paying More?



**Model R Receiver**  
Complete Without Tubes **\$90**

### ALL-AMERICAN Challenges Comparison on the basis of the Six Vital Principles of Solid Value in Radio Receivers

- |   |   |
|---|---|
| <p><b>1 Quality of Tone</b> The Model R Receiver is equipped with Rauland-Lyric laboratory-grade transformers—designed especially for music lovers, and the choice of music critics.</p>  | <p><b>4 Selectivity</b> Extreme sharpness of tuning has been achieved solely through improved condenser and inductance design, without impairing tone quality.</p>  |
| <p><b>2 Ease in Tuning</b> Two dials (360° type, all markings always visible while tuning) control the ALL-AMERICAN Straight-Line-Frequency TUNING, reaching all broadcast wave channels and eliminating all crowding of low-wave stations.</p> | <p><b>5 Sensitiveness to Distant Signals</b> The ALL-AMERICAN Tuned-Radio-Frequency system results in a sensitiveness which challenges comparison with any other set made, irrespective of the number of tubes.</p> |
| <p><b>3 Quietness</b> ALL-AMERICAN Toroids practically eliminate the stray noises which ordinary coils pick up. Rauland-Lyric tone amplification results in a remarkable quietness.</p>   | <p><b>6 Appearance and Serviceability</b> The beautiful two-tone walnut cabinet, with inlaid designs, has ample space within it for all batteries or for a "B" socket-power if preferred.</p>                       |

*Have your dealer demonstrate the Model R for you*

The leading wholesaler of radio apparatus in your community has probably been, for years, an ALL-AMERICAN Authorized Distributor. ALL-AMERICAN Guaranteed Radio Products are sold everywhere by responsible and reliable dealers.

ALL-AMERICAN RADIO CORPORATION, E. N. Rauland, *President*, 4215 Belmont Ave., Chicago



OWNING AND OPERATING STATION WENR—266 METERS

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*Pioneers in the Radio Industry*